consulting engineer

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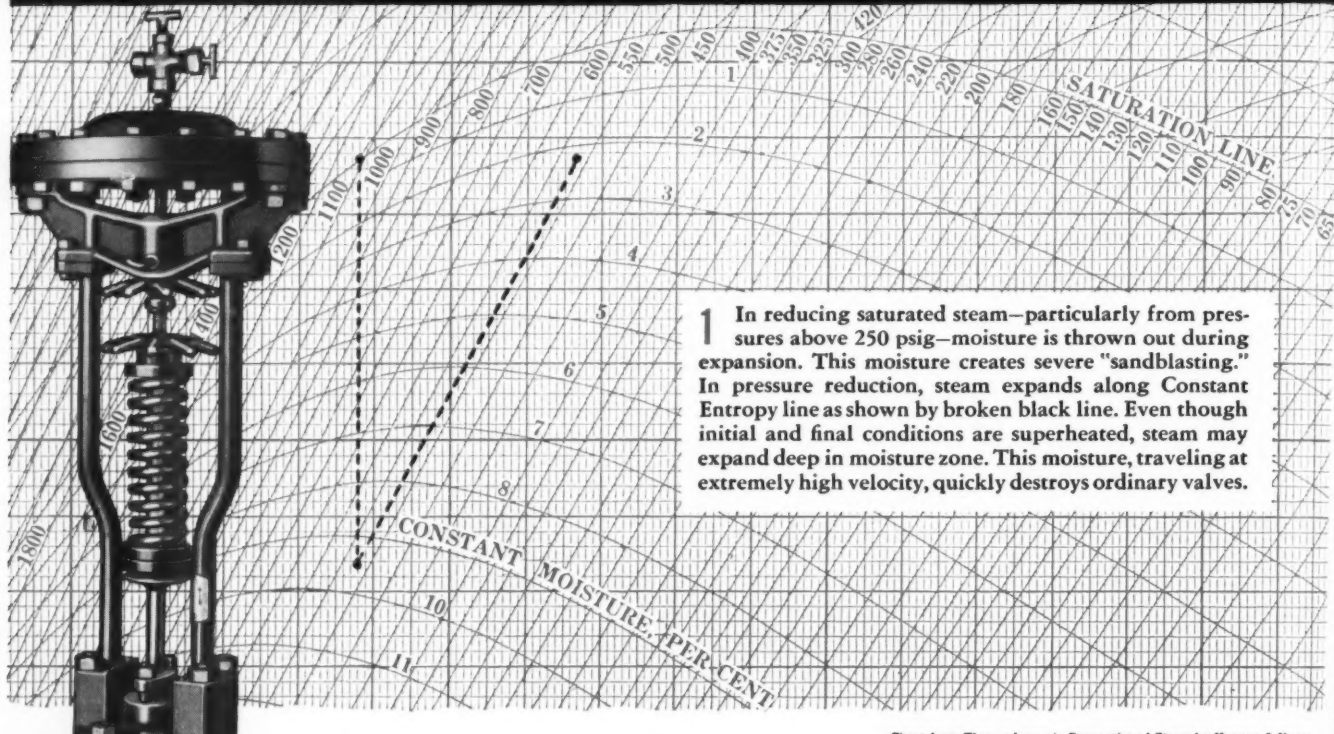
. . . . a future in foundry modernization

Successful Newcomer

LESTER B. KNIGHT, in the spring of 1945, was one of the many discharged veterans wondering which way to turn. He could have continued the promising career that had brought him to the vice-presidency of the National Engineering Co., or, he could have selected from other good offers from

(Continued on page 6)

Swartwout V-10 Flow Regulating Valves slash maintenance costs in systems with high pressure drop or flashing condensate



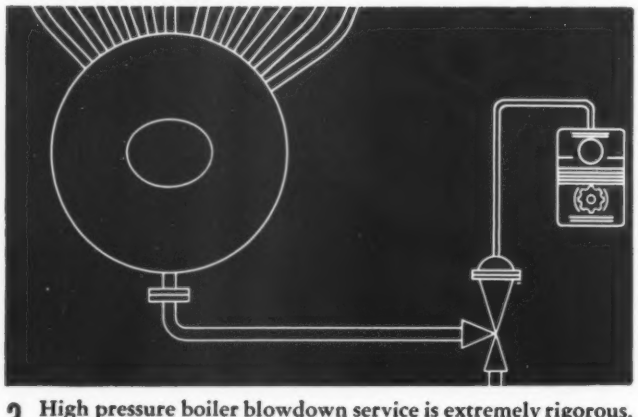
1 In reducing saturated steam—particularly from pressures above 250 psig—moisture is thrown out during expansion. This moisture creates severe "sandblasting." In pressure reduction, steam expands along Constant Entropy line as shown by broken black line. Even though initial and final conditions are superheated, steam may expand deep in moisture zone. This moisture, traveling at extremely high velocity, quickly destroys ordinary valves.

Chart from *Thermodynamic Properties of Steam* by Keenan & Keyes. Reproduced by permission of John Wiley & Sons, Inc., Publishers

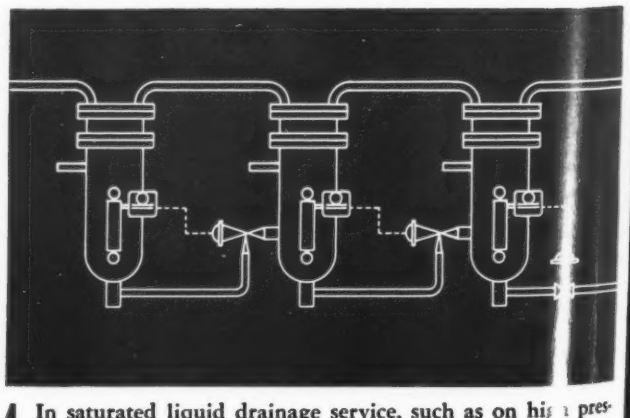
2 Swartwout V-10 valves are scientifically designed to handle liquids at high pressure drops and also under *flashing conditions.* All direct impingement is eliminated and longer valve life is assured two ways—by better flow design, plus use of materials specifically selected for the service involved. As a result, *Swartwout V-10 valves outperform other valves in similar service.*

Swartwout

POWER PLANT EQUIPMENT
PROCESS INDUSTRY CONTROLS
INDUSTRIAL VENTILATION



3 High pressure boiler blowdown service is extremely rigorous. When closed, there is full pressure drop across valve; when open, high velocities and flashing rapidly increase line loss and decrease the allowable drop across the valve. The variations in pressure make this service critical since valve must handle all conditions.



4 In saturated liquid drainage service, such as on hig[h] pressure extraction type heaters, water at saturation tem[p]erature flashes into steam when pressure is reduced. Exclusiv[e] scroll inlet and gradually expanded straight outlet of V-1[0] valve design permit a sliding action instead of direct impi[n]gement thus preventing corrosion-erosion.

A-4206

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NUMBER 9

consulting engineer

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NOVEMBER 1953

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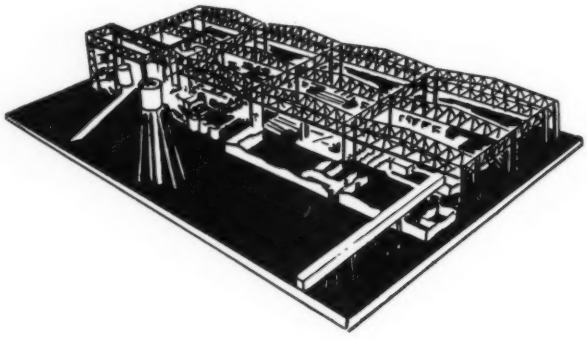
Successful Newcomer

—Starts on Front Cover

industry but one proposition seemed outstanding. It came from an old friend, General Thomas S. Hammond, at the Whiting Corp. ". . . . go out and spend three months looking over our operations," said Hammond, "then you can better decide whether to join our organization or whether you want to try independent consulting." As it turned out, Hammond got a survey report, Les Knight got his first client, and the consulting field got Les Knight.

Starting with this assignment in May, 1945 Knight went after other business and in three months had several millions of dollars in plant modernization work on the books. There was no staff in May. By September, there were 15 employees, and by December of the same year 28 were on the Knight team. In 1953 the staff had grown to 120.

Ask Knight the reason for his outstanding growth in the conservative realm of management consulting and he'll tell you that the time was opportune and that plant modernization and mechanization were undeveloped fields. But that alone would be overlooking the caliber of the man, his reputation, and his broad experience.



Graduating from Cornell in 1929 with his M.E. degree, Knight joined Illinois Clay Products Co., and in 1930 joined National Engineering Co. At that time, the company was small—furnishing equipment largely to the foundry industry. By 1942, it had expanded its sales to many different process industries and to a $7 million annual volume. And Knight had become its vice-president.

During the war, Les Knight was commissioned a Lt. Commander in the U.S. Navy and was placed in charge of the Foundry and Forging Section of the Facilities Branch of the Bureau of Ships. This department provided some $600 million in new plant construction used for manufacturing items ranging from crankshafts to ships' armament. It was Knight's job to see that the plants were completed and produced in accordance with original plans. The construction program completed, Knight was part of a 10 man team, reporting directly to Secretary of the Navy Forrestal, making an eight month study of Navy industrial facilities and organizations on the East coast to determine "efficiency of operation and utilization of manpower." As a result of this study, the Shore Division of the Bureau of Ships was established by the Navy.

Initially specializing primarily in foundry design, construction management, modernization, and reorganization work, Lester B. Knight and Associates, Inc., have completed jobs for some of the country's largest firms; foundry mechanization and modernization for Worthington; design and construction supervision of the Kansas City plant of Fairbanks-Morse; complete plant set-up for manufacturing malleable iron fittings for the Crane Co.; a plant for freight car ends and roofs for Standard Railway Equipment; to name just a few from the record.

A few years ago, Universal Castings Corp. gave the Knight Organization a five year contract to reorganize and place on a profitable basis their operations which were then losing at the rate of $35,000 per month. The management fee was to be a percentage of profit before taxes. At the end of four years, after paying off most of the debt, Knight purchased Universal and continues to operate it as a profitable enterprise. Thus, he has had opportunity to demonstrate the soundness of his business policies.

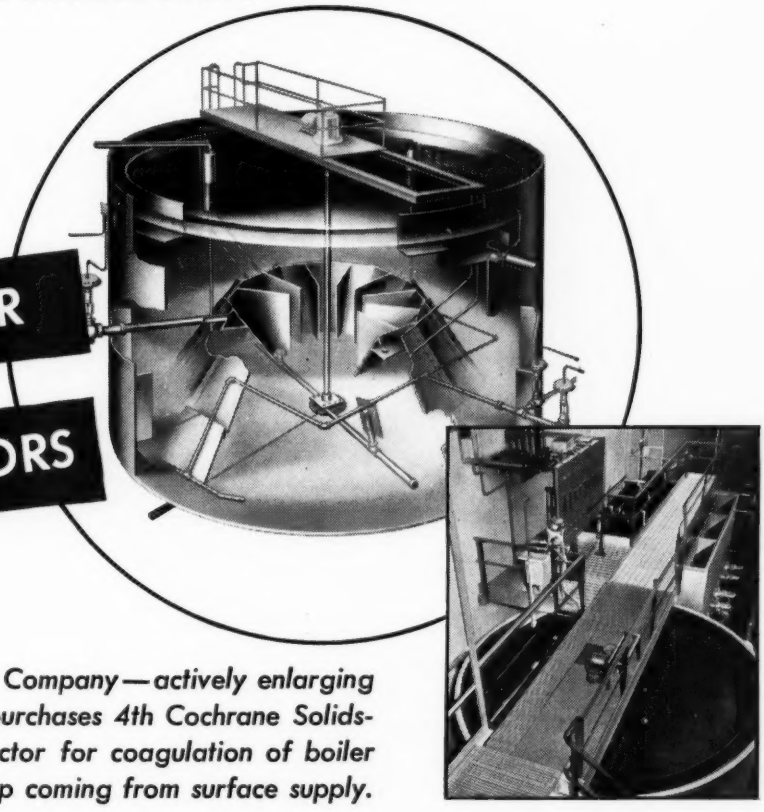
In the course of acquiring the personnel for work in the foundry field, he found he had talent that could deal with functions that were common not only to foundry work but to other manufacturing plants as well. On the basis of their broadening organization, Knight and Associates have expanded and developed a comprehensive management, industrial and plant engineering (including architectural service).

Les Knight has been the firm's best salesman. He makes it his personal business to call on each potential client. Without either party assuming any obligation, with the potential client paying actual expenses and Knight giving his time, the problem and the desired results are discussed. This method has made friends and customers and has done much to spread his reputation.

What's in the cards for the future? Les Knight believes that with approximately 60 percent of the industrial capital plant facilities in this country obsolete or worn out, based on today's wage costs per unit of production, there is a lot of plant modernization to be done. However, whether the businessman can afford or continue to be willing to invest the necessary capital almost certainly depends, Knight thinks, upon the type of tax legislation that the Congress may enact. The future will demand more and better management control, improved utilization of manpower and greater efficiency of operation.

COCHRANE WATER CONDITIONING
STARTS WHERE NATURE STOPS

REPEAT ORDERS FOR COCHRANE REACTORS



Duke Power Company—actively enlarging capacity—purchases 4th Cochrane Solids-Contact Reactor for coagulation of boiler feed make-up coming from surface supply.

• This record of repeat orders is evidence of successful design and performance. Units are being built for coagulation, lime softening, iron removal, fluoride removal, white water recovery in paper mills, cooling water treatment, process water clarification, tin plate rinse water, oil field flooding water and similar applications.

They can be built in small sizes—such as for the bottling trade, or in very large sizes—such as for paper mills, up to 110′0″ dia., capable of handling more than 20,000,000 GPD in a single unit.

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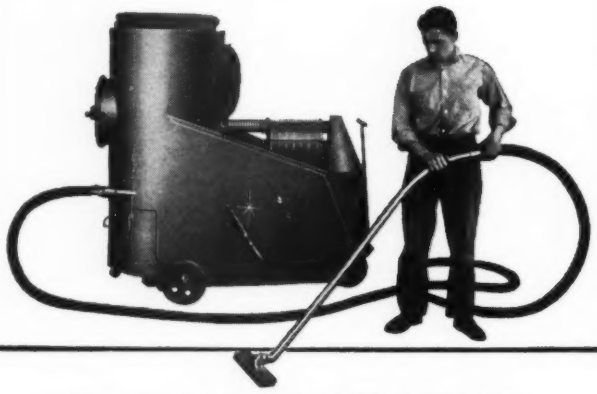

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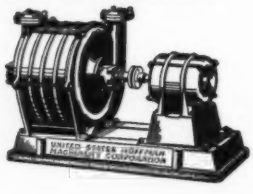

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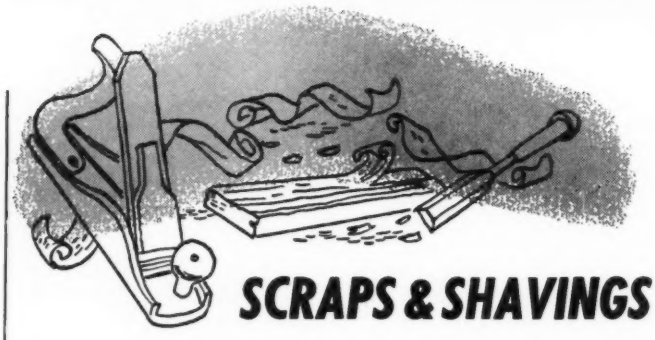


SCRAPS & SHAVINGS

JUST TWO WEEKS AGO we were in Dallas, Texas, and stopped for a short visit with the Engineers Club of Dallas. This is a relatively new organization, having been founded just four years ago. Its membership is limited to engineers and scientists, and its first purpose is fellowship.

The group has assumed two outside responsibilities and is following them through in a most commendable manner. They have taken it upon themselves to acquaint local high school students with the qualifications for, the requirements of, and the opportunities in the engineering profession. They have also set up scholarships to aid needy, deserving college engineering students.

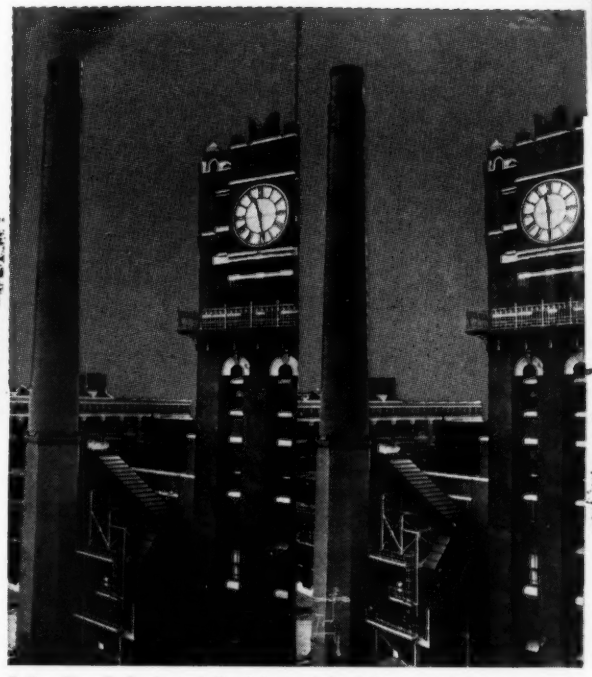
One part of their program consists of an annual Engineers Banquet to which 250 senior high school students are invited as the individual guests of 250 engineers. At this dinner, prominent speakers explain to the students the opportunities open to men who enter the engineering profession. The Engineers Club then presents to the student with the highest scholastic average from each high school in Dallas, the "most magnificent, engraved slide rule" which can be purchased. Then, as the climax of the dinner, an announcement is made of scholarship awards.

The Engineers Club gives three $500 scholarships each year. The first consideration is need. They want the money to go only to boys who could not otherwise attend college. Once need is established, the applicants are rated as to character, scholastic ability, personality, and are given tests by the Dallas Community Guidance Service to determine engineering aptitude.

The students receiving the scholarships can choose any accredited engineering school, and they continue to receive the scholarships every year so long as the need exists and they pass their courses to the satisfaction of the Club's Scholarship Committee. It is recognized that even these sizable scholarships will not cover the students' minimum financial requirements, so the members go further and provide summer jobs and part time employment at school.

The money comes partly from the club treasury and from profits on buffet suppers. They also operate buses to football games, hold gin rummy tournaments and an annual golf tournament. There are contributions from members and firms. Currently they have one scholarship recipient in Texas A & M, one in S.M.U., two at Rice, and one at the University of Oklahoma.

Less dust for St. Louis housewives...



Boiler No. 5 Stack and Precipitator left—before precipitator start-up right—precipitator in operation [boiler load 200,000#/hr.]

Anheuser-Busch leads the way with AEROTEC Electrical Precipitators

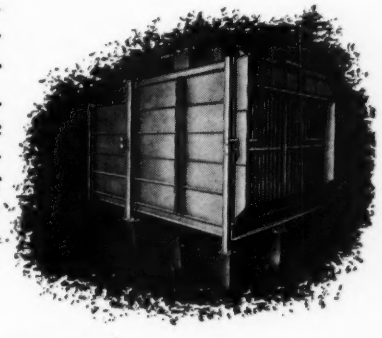
The brewers of famous Budweiser Beer know the importance and value of good public relations. Not content with just meeting local requirements for dust control, the Company sets the pace for air-pollution control in St. Louis.

Together with an existing mechanical collector, the first of five Aerotec Electrical Precipitators at Anheuser-Busch *is collecting 2000 lbs. of dust every 60 minutes from a single stack.*

The remaining four electrical precipitators are about to be placed in service, and dust emission will be less than one fourth of the maximum allowable under the requirements of St. Louis' dust ordinance.

Reasons for Aerotec's higher collecting efficiency are:

- Pocket-type collecting electrodes prevent precipitated dust from re-entering gas stream.
- Exclusive flat high voltage plate presents a field of uniform maximum intensity for most effective precipitation.



For other advantages of Aerotec Electrical Precipitators write or call our project engineers—Thermix Corporation.

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(Offices in 38 Principal Cities)

Canadian Affiliates: **T. C. CHOWN, Ltd., Montreal 25, Quebec; Toronto 5, Ontario**

Manufacturers

THE AEROTEC CORPORATION

GREENWICH, CONN.

N. Y. Ass'n of Consulting Engineeers

Sir:

I have read your article in the August issue of CONSULTING ENGINEER giving the experience of Elwyn E. Seelye. I am sure that this article will be of interest to your readers as it has been to me. May I suggest that you consider an article on the New York Association of Consulting Engineers. This Organization has been in existence a comparatively short time but includes among its membership all the practicing professional engineers in New York City. I am sure that an article which covered the aims and objects of the Organization and what it has been able to accomplish would be of interest to other practicing engineers who might be encouraged to establish similar groups throughout the United States.

Licensed professional engineers are not for the most part practicing engineers; they included employees in large corporations, Civil Service employees of County, State and Federal Governments, and others. On the other hand, the Organization mentioned above includes only those engineers who are actually practicing professional engineering and whose problems are, therefore, common to all of them.

At the present time Colonel Value of the firm of Seelye, Stevenson, Value and Knecht is President. One of the past presidents is Mr. Hennessy of Sysca and Hennessy. Mr. Pryke of Slocum and Fuller is the present Secretary and Harry Bond is Treasurer.

Harry Terry, CE
Scarsdale, New York

• AN ARTICLE ON NYACE IS BEING PREPARED FOR AN EARLY ISSUE.—ED.

Valuable Articles

Sir:

I wish to compliment you on the type of magazine that you are turning out, and can sincerely state that there have been . . . articles in your magazine which have been of extreme value to me.

Carl C. Crane,
Carl C. Crane, Inc.
Madison, Wisconsin

Ancient Escalator

Sir:

In connection with the article "Steeper Moving Stairways Make Sense" by G. B. Gusrae, which appeared in the September issue of CONSULTING ENGINEER, your readers may be interested in the attached print showing another Reno type escalator. It dates back to about 1910 and shows one of the first five and ten cent store installations. This one was installed in a Woolworth store in Newark, New Jersey.

Howard Gotthardt
Otis Elevator Company
New York 1, New York

Belated Credit

Sir:

How can you expect to make practicing consulting engineers your friends or contributors if you publish accounts of their prominent projects without one word of praise or even identification. This . . . is prompted by the article in your September issue describing the Alcoa Building. This is an outstanding building with many features of real architectural and engineering interest. But no where in it can I find the slightest reference to the fact that:

(a) Harrison & Abramovitz, as architects, were directly responsible for the entire concept, coordination of details, and layout of the building.

(b) Edwards & Hjorth designed its structural framework.

(c) Edward E. Ashley designed all of the electrical and illuminating features which you found so interesting.

(d) Jaros, Baum & Bolles designed the entire mechanical plant, to which you devoted 40 percent of your illustrations—after a year's research (in collaboration with the Alcoa Laboratories) into the possibilities and design criteria for radiant cooling—never before attempted on a comparable scale . . . .

Alfred L. Jaros, Jr.
Jaros, Baum & Bolles
New York, New York

• HEREWITH BELATED CREDIT WHERE CREDIT WAS CERTAINLY DUE EARLIER. OUR SINCERE APOLOGIES TO MESSRS HARRISON, ABRAMOVITZ, EDWARDS, HJORTH, ASHLEY, JAROS, BAUM, AND BOLLES. A LIST OF CREDITS HAD BEEN PREPARED AND WERE OMITTED IN ERROR.—ED.

Letters from Ladies

Sir:

Your publication must have touched the heart of many readers, laymen as well as the members of the profession.

What surprised me is to see so many wives of engineers reading CE and finding time to write to the editor. Sometime ago you had an article on why the engineer should follow his profession and leave public affairs to others. A wife of an engineer read it, wrote to you, and even asked you to send another copy.

In your August issue Katheryn H. Powers, a public relations career woman, finds V. W. Palen's "Your Firm Can Afford Publicity" article powerful and asks permission to reprint it "in toto."

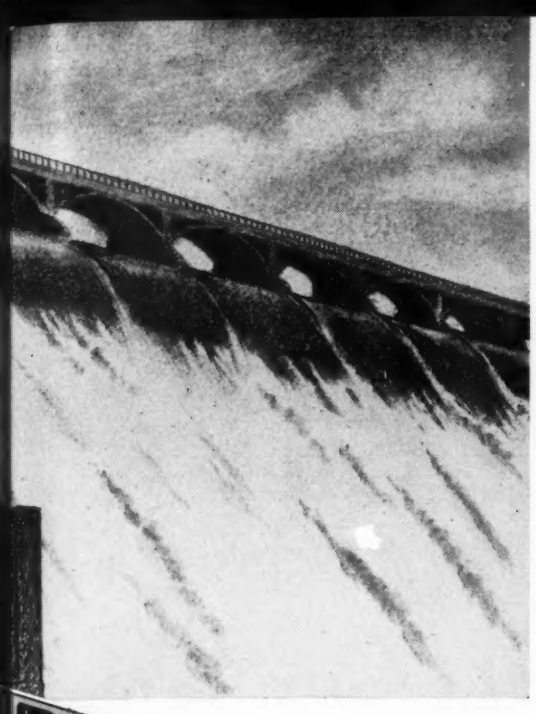
I wish you success and keep up the good work.

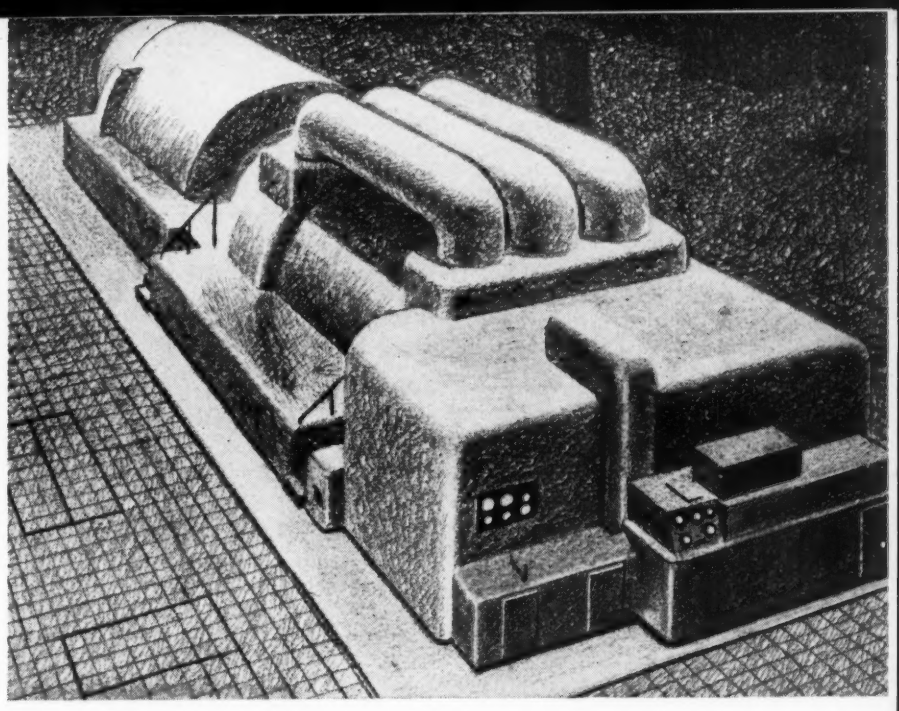
Yasha Yavitch
Jacob Yavitch
Glenolden, Pennsylvania

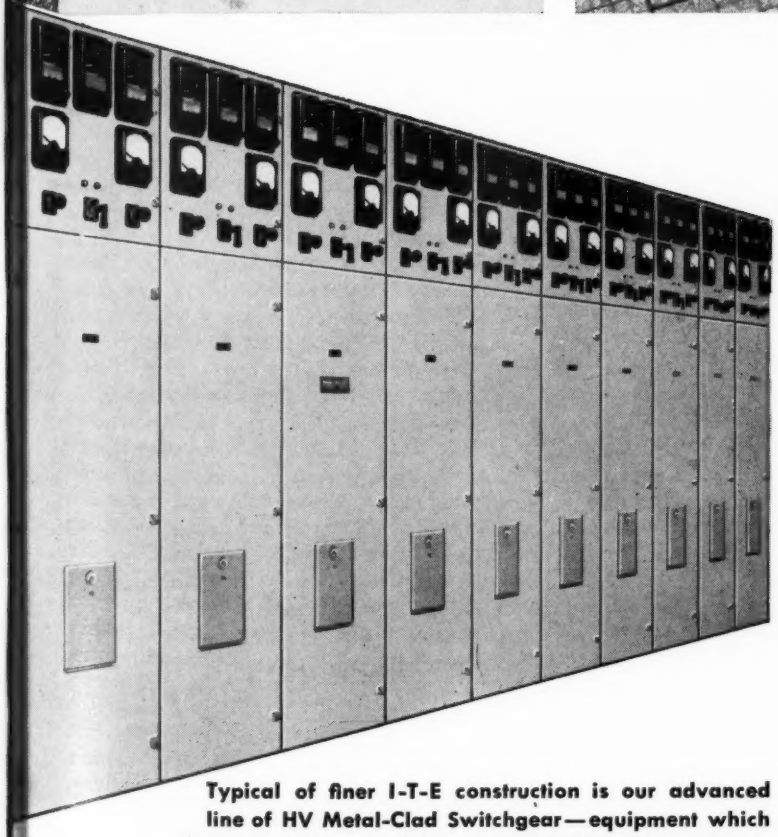
Atomics for Students

Sir:

Professor Morse has shown me the July issue of CONSULTING ENGINEER which contains the article on "Industry and Atomic Power" by Bergen. Nuclear energy has recently become one of my principal interests, and I am presently trying to set up work in this field at the University. If reprints of this article are available, they will be both useful







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- the first isolated-phase bus

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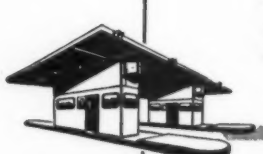

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and interesting to my class in nuclear reactor theory. I shall appreciate ten copies for this purpose.

Lawrence R. Quarles
Professor of Electrical Engineering
University of Virginia

Missing Issues

Sir:

Please send me a copy of the July, 1953 issue and one copy of the February, 1953. Your magazine is very popular in the office and the two copies mentioned above have disappeared.

Richard T. McKay
Johnson & Johnson McKay and Chan
Houston, Texas

Sir:

It would be very much appreciated if you could send me copies of each of the January and February 1953 issues of your magazine. My copies have been lost and I am interested in reviewing certain articles from these issues.

J. D. Grothe, Manager
Consulting Engineer Dept.
The Dorr Company
Stamford, Connecticut

Sir:

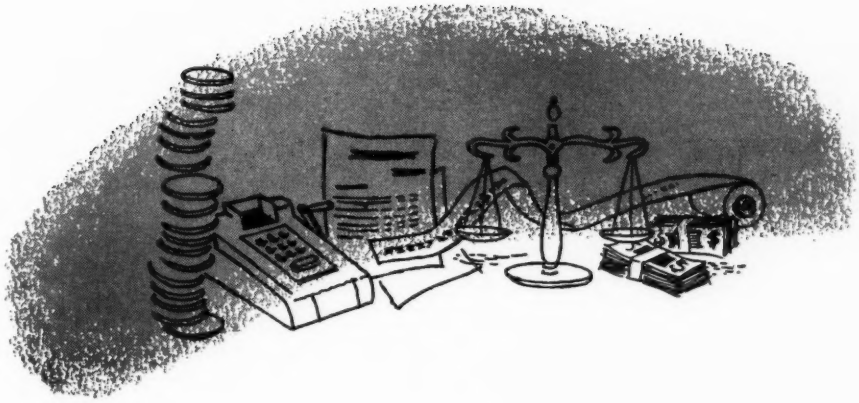
I asked that the January and February, 1953 issues of your magazine be sent me to fill two gaps in our file. I am quite sure that these were received but that one of the employees carried them away. In fact, it was for that reason that I requested that two subscriptions be sent to our organization, one of which will have to remain available to all members of the organization and the other will be bound in a permanent file for the library.

Incidentally, will you have a binder available for your monthly issues, imprinted with the name, volume number and year, which can be purchased? This would do a lot toward keeping your publication out of the throw-away category which catches up with so many publications . . . .

T. B. Wayne
Truman B. Wayne & Associates
Houston, Texas

● WE SUPPLIED READER McKAY WITH THE MISSING JULY ISSUE. FURNISHING READERS GROTHE AND WAYNE WITH JANUARY AND FEBRUARY ISSUES IS MORE DIFFICULT. **CONSULTING ENGINEER** DID NOT BEGIN REGULAR PUBLICATION UNTIL MARCH, 1953. THERE WAS A PRELIMINARY ISSUE PUBLISHED IN DECEMBER WHICH ACCOUNTS FOR THE CONFUSION. ARRANGEMENTS ARE BEING MADE TO PROVIDE SPECIAL BINDERS FOR TWELVE ISSUES OF **CONSULTING ENGINEER**, WHEN AVAILABLE, PRICES WILL BE PUBLISHED. —ED.

ECONOMIC NEWS NOTES

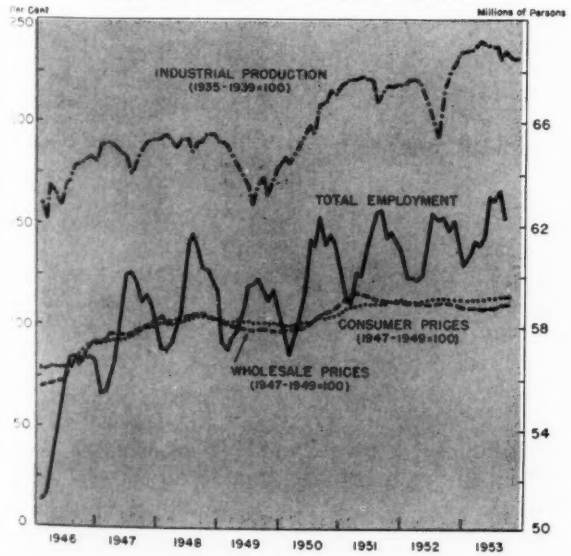


E. F. Mac Donald
INDUSTRIAL ECONOMIST

WITHOUT JEOPARDY — After studying for a year the question: Can the U. S. afford substantial additions to its present defense program — a committee of the National Planning Association answered "yes," adding that it could be done without jeopardizing the Administration's "sound dollar" policy or stifling labor and management incentives. "We are convinced that the U. S. does not need a huge armaments program to maintain a healthy economy," but so far as the question of whether the country could afford greater security outlays is concerned, it held that an expansion of such spending to $70-75 billion by 1956 would "lie within the nation's financial and economic capacity without necessitating wartime controls." This report would take on great significance should there be another flareup in the Far East or in one of the other hotspots of the world.

TWIN TARGETS — The title of the accompanying chart may sound ambiguous — growth and stability at the same time. It is, however, the objective of our economy to maintain maximum employment and production as well as stability. Nothing will contribute so much to domestic and international peace and progress as eradication of violent changes in business activity. As shown in the chart, employment and production have been at record peacetime levels in the last two years while average prices have been relatively stable, consumer prices inching up very moderately and wholesale prices declining moderately from the early 1951 peak.

PROBLEM: GROWTH AND STABILITY



INDUSTRIAL FILLIP — Another offset to any downturn in business activity will be created if reports that a moderate increase in defense spending next year are true. It is reported that a $500 million supplemental request is being prepared for Congressional approval. Industries directly concerned would likely include aircraft, guided missiles, electronics, and AA munitions. Although the amount is relatively small, indirect benefits, the multiplier effect, would be substantial.

RATE REDUCTION — A substantial reduction in freight rates on iron and steel products shipped from all points in Eastern territory to Southern territory addresses takes effect November 21 unless efforts to advance the date to November 5 are successful. Savings to shippers will be substantial and particularly important in view of the resumption of freight absorption. Prior to the new rate schedule, for example, a 40-ton carload shipment of iron or steel from Cleveland to Charlotte cost about $883, less tax; now the cost is around $608.

ODDS AND ENDS — ***General Electric*** has advanced factory automation another step with a tape recorder that records motion rather than sound. Played back, the tape causes a machine to duplicate original operations and produce parts identical to the one made when the magnetic tape was recorded . . . Talk of a guaranteed annual wage is, according to a study by the ***U. S. Chamber of Commerce,*** in reality a demand for adequate job opportunities and high-level employment. Hence, the report concludes, "If we maintain reasonably stable prosperity in the years ahead, this is what the American people want and will settle for." Could be, but be prepared for an intensified drive toward this objective next year . . . Proposed new ***state and local bond issues*** presented for voter decision last election day, November 3, totaled around $850 million, the second lowest total for any November balloting in the postwar period and only a little more than half last year's total . . . Technological change and research are advancing so rapidly that earlier observations of ***C. F. Kettering*** are more apt and pointed than ever: "Prosperity and obsolescence are absolutely tied together, and absolescence makes prosperity. A research organization is the originator of obsolescence . . . Research is an organized method for keeping you reasonably dissatisfied with what you have . . . Research is an organized method of finding out what you are going to do when you can't keep on doing what you are doing now . . . There is one great problem in industry which is not understood at all, and that is that the distance between the concept of an idea and putting it on a profit-and-loss basis is getting longer and longer.

ATOMS IN ACTION

ATOMIC ENERGY CONFERENCE — The National Industrial Conference Board held its second annual conference on atomic energy October 29-30 in New York City. It proved to be the sounding board for the most recent opinions and prognostications. Among the most persistent views going the rounds was the one that 50 percent of the power generated in the United States will come from atomic reactors within the next 25 years.

ATOM-POWERED AUTOS — Walter E. Kingston, general manager of Sylvania's Atomic Energy division, predicted before the NICB sessions that nuclear fuel, coupled with other reactor developments, will ultimately propel rockets beyond the earth's gravitational field and that nuclear engines can be developed for trains, trucks, and perhaps even automobiles. Kingston sees all this becoming reality within the next two or three generations.

BIG-SOUNDING PROPOSALS — Closer to the ground, there is the problem of enlisting capital in the atomic energy development program. Chet Holifield, U. S. House of Representatives and member of the Joint Atomic Energy Committee, set out the problem as the House-Senate committee had found it: "The blunt fact is that the Joint Committee had received no reliable evidence whatever to support the contention that private industry — or any segment of it — was prepared to invest the large sums of money required to carry forward the atomic power development program without very extensive government support, including guarantees against loss or failure. So it was only natural that our curiosity was aroused by these big-sounding proposals . . . After twelve very thorough discussions with [industry] individuals, the Joint Committee was unable to discover any sound basis for the proposition that if the government would step out of the atomic power picture, American industry was ready and able to pick up where the Atomic Energy Commission left off."

INDUSTRY AND GOVERNMENT — "The government and industry should get together and proceed to build and operate one or more nuclear power plants as founddations of experience upon which our scientists and engineers will build tomorrow's economic nuclear power." Such is the expressed view of D. R. Bower, treasurer of Chicago's Commonwealth Edison Company. He believes that the main obstacle to economic nuclear power is lack of experience which "can be gained only by building and operating one or more large-size reactor power plants."

COMING LEGISLATION — Speaking before the NICB, Eugene M. Zuckert, member of the Atomic Energy Commission, recommended provision of legislation "which will be an incentive for private capital to assume part of the load of exploration in the field of nuclear power but which will not constitute a legislative straightjacket to technological development." Underscoring this statement was the one made by Representative W. Sterling Cole, chairman of the Joint Committee who said, "It is my intention in January to introduce legislation — in cooperation with the (Atomic Energy) Commission and the administration — to the end that private development of atomic power may go forward." (Representative Cole would give no indication as to what his proposed legislation would be nor would he say what areas it would cover.)

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The new Dravo *Paraflo* Space Heater is designed for heating open areas in small commercial and industrial buildings. Typical installations include service stations and garages, construction offices, warehouses, recreation centers, agricultural buildings, stores, offices and showrooms.

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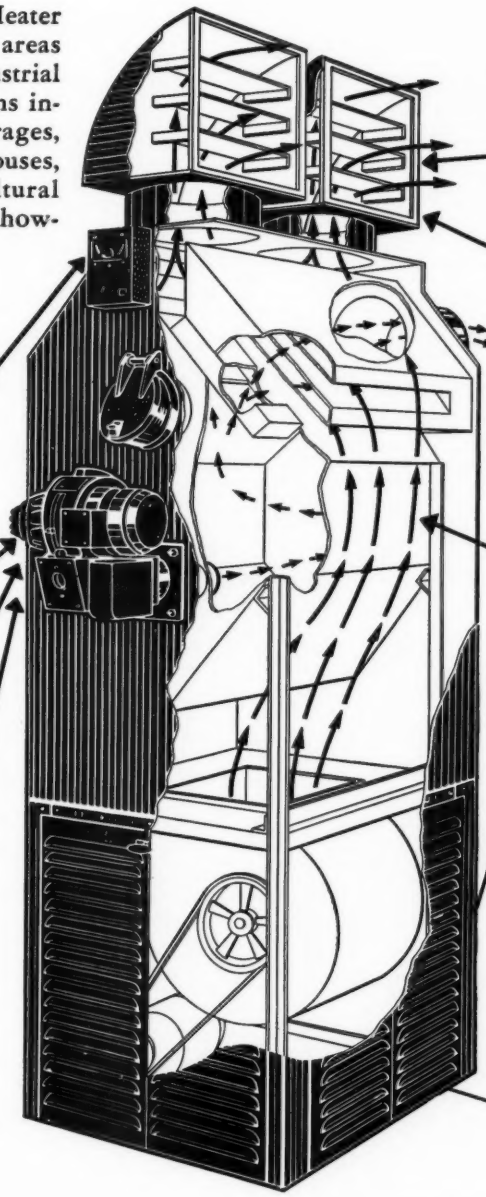

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BY USING TEMPLATES FOR LAY-OUT WORK, RELIANCE ELECTRIC & ENGINEERING HAS REDUCED THE NUMBER OF DRAFTSMEN NEEDED, AND AT THE SAME TIME HAS SPEEDED SERVICE TO CUSTOMERS.

Reliance Electric

Nobody Wants to Be a Draftsman!

CE exclusive

JACK HINKLEY
Associate Editor

ALTHOUGH ENGINEERING FIRMS offer many services, the client must necessarily be sold through drawings and written reports. Mechanical drawings are a vital commodity of the consulting engineer, and the men who make the drawings must be considered an all-important segment of the firm's personnel. Despite this fact, good draftsmen are hard to find and just as hard to hold.

The situation was well summarized recently by a member of a Chicago consulting firm when he stated, "Nobody wants to be a draftsman. As soon as a man has worked as a draftsman for a few months, he wants to be a designer. After working as a designer a few more months, he wants to be an engineer."

The solution to the problem of maintaining an adequate drafting force is not simple. The up-the-ladder system of draftsman to designer to engineer must exist in order for a firm to function. Employees expect periodic raises in salary. After a number of years, a draftsman's wage approaches that of a designer's. If he is ambitious, he will not be content to work on a fixed salary without opportunity for advancement. Consequently he must move up to the position of designer, or in some instances, to positions leading toward management. If he is not ambitious, the chances are good that a lack of initiative will show up in his drafting work.

Recruiting Draftsmen

Promotions to the position of designer leave vacancies in the drafting room, thus creating a never-ending recruitment problem. The use of higher wages as an employment incentive provides only temporary relief, since it shortens the time before

the draftsman's wage approaches that of a designer.

Various companies have established special training schools as a means of attracting young men and women. The Lunkenheimer Company recently announced the graduation of nine Cincinnati high school students from a course in draftsmanship conducted by the company and coordinated with the students' other school activities. Such a limited type of training, however, does not sufficiently prepare the student for future responsibilities in engineering concerns. Consequently, schooling of this type should prove of the most value for young women, since most leave the firm within a short number of years to establish families.

The most promising solution to the drafting problem appears to be in the adoption of techniques that reduce the time required to produce a completed drawing. In addition to reducing the staff required, such procedures provide quicker service to the client and lower the cost of preparing drawings.

Simplified Drafting

Important time and labor reductions can be accomplished by stripping the frills from drafting work. The end result of design and drafting is fabrication, erection, and operation—not art presentations. Yet most firms still use the long-established procedures which demand that professional pride find expression in exacting and painstaking artistry.

To the client, the esthetic aspects of accurate pictorial presentations have little value. What he wants is information—complete, concise, and accurate—and on time.

Simplified drafting methods are not new. Although perhaps not recognized as such, the basic concepts have been employed by draftsmen for many years. As an example, few draftsmen attempt an accurate pictorial representation of screw threads—yet this was common practice at one time.

Eliminating Unnecessary Work

With sufficient experience, a draftsman should be able to select views that adequately present the required information with the least amount of drawing effort. However, conventional presentations often result in one or more views which could be eliminated without impairing the drawing's value.

A typical example of unnecessary views is the conventional method of presenting fabricating information for standard structural members. The extreme example occurs when a time-consuming drawing is made to convey information which could easily and clearly be described with written instructions. When instructions become too complicated and a drawing is indicated, the conventional method is to show three views—top, side, and end. Oftentimes the end view can be eliminated by including the required thickness or diameter in a standard specifications note.

Eliminating unnecessary elaboration is another means of simplifying drawings. It is commendable that a draftsman should take enough pride in his work to make a good drawing. However, a good drawing is established by clean line work, well-selected views, proper dimensioning, and economy of presentation—not by elaboration or artistry.

Had the draftsman considered the purpose of the drawing shown in Fig. 1, the results of his efforts should have been the simplified presentation shown at the right. It should be noted that two important

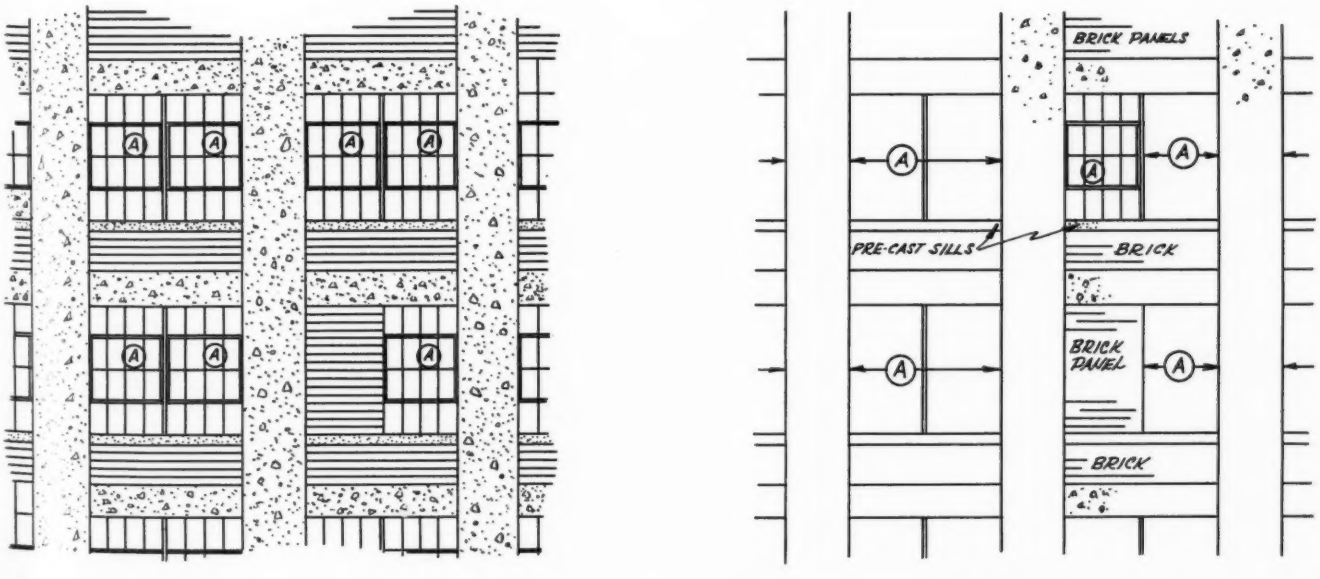
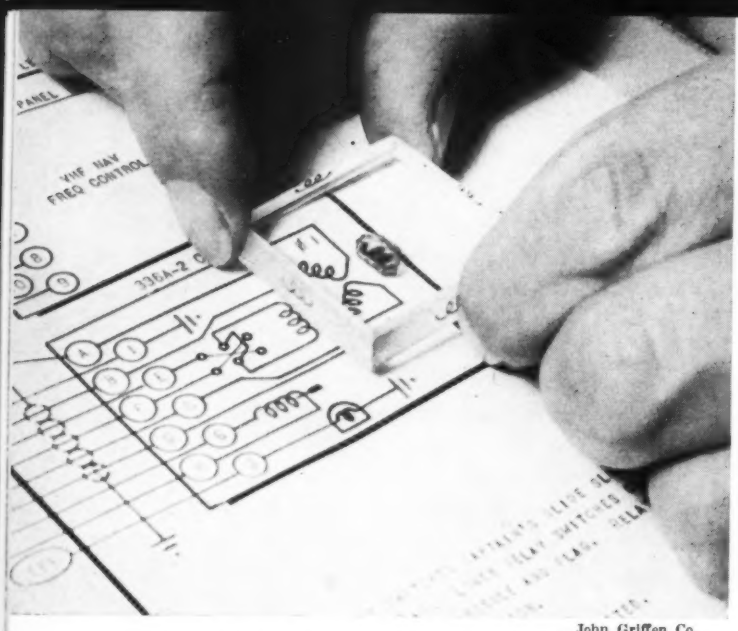


FIG. 1—SIMPLIFIED TECHNIQUES, AS SHOWN AT RIGHT, PERMIT IMPORTANT REDUCTIONS IN DRAFTING TIME.



John Griffen Co.

TRANSPARENT PLASTIC STAMPS PERMIT ALIGNMENT WITH CONNECTING LINES ON THE DRAWING

techniques were used to eliminate unnecessary line work in the simplified view.

By comparing the two views, it can be seen that only small portions of the pictorial representations of construction materials are needed. The same concept can be applied to cross-hatching when sectional views are involved.

In addition, unnecessary repetition of identical components has been eliminated. When identical parts such as the windows are shown, all but one can be adequately represented by a simple outline and a reference to the part drawn in complete detail.

The concept of eliminating unnecessary repetition also can be applied to notations. All repetitive notes can be referred to one notation that provides full information. If a large number of repetitive instructions are involved, it is often more convenient to use letters or numbers referring to a table of specifications. With a tabular form of this type, a typewriter can be used in place of hand lettering to further reduce preparation time. In many instances, fewer notations also permit preparation of the drawing on a smaller scale.

Abbreviations offer a further means of simplifying instructions. The American Standards Association has established a committee to arrive at and publish a nationally accepted list of abbreviations to be used on engineering drawings. This list is identified as ASA bulletin Z32.13-1950. The Munitions Board Standards Agency has issued a similar list, identified as MIL-SPD-12.

Symbols

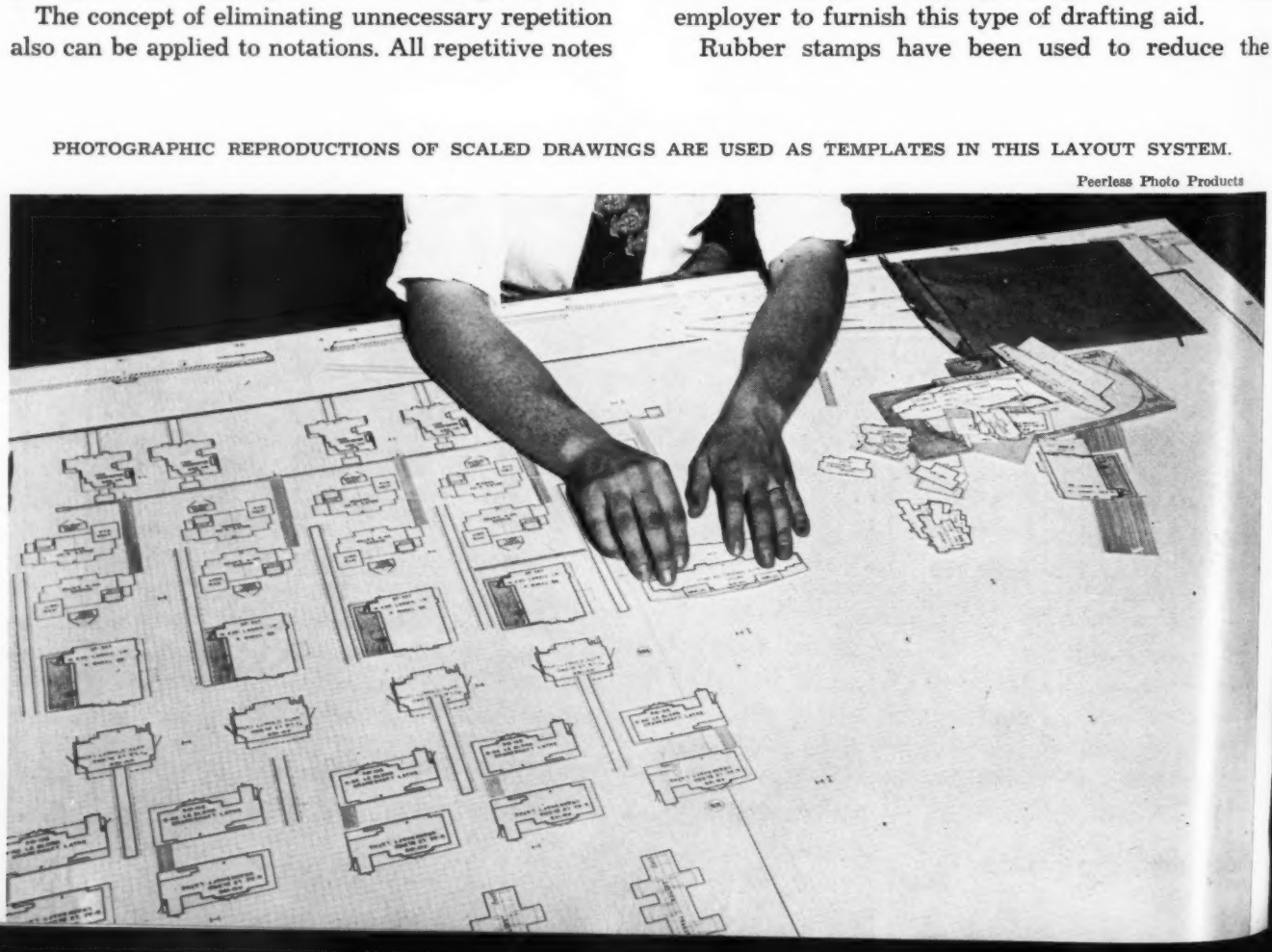
Symbols provide another means of eliminating repetitive work. Electrical engineers have been effectively using them for years. They are now widely used for piping layouts, and many industries have established standards for the symbols used in their fields. Any symbols which are not standard can be explained in an accompanying legend.

Inexpensive, transparent templates are used by many draftsmen as a guide for tracing symbols and irregular shapes. In most instances it has been necessary for the draftsmen to supply their own templates. Since most of them do not possess a sufficient variety, it might prove profitable for the employer to furnish this type of drafting aid.

Rubber stamps have been used to reduce the

PHOTOGRAPHIC REPRODUCTIONS OF SCALED DRAWINGS ARE USED AS TEMPLATES IN THIS LAYOUT SYSTEM.

Peerless Photo Products



tedious drawing of symbols and repetitive portions of drawings. One manufacturer, John Griffen Co., has recently introduced plastic stamps mounted in clear plastic to facilitate alignment with connecting lines on the drawing. Although these stamps are not inexpensive, they can be used to print large, complex symbols or complete portions of drawings.

Pre-printed, pressure-sensitive overlays offer still another means of cutting down drafting time. They are available in transparent types for diazo printing and opaque types for photocopying, and can be had with the adhesive on either the back or front side for direct or reverse application. Manufacturers, such as Johnson Research Corp., Stanpat Co., Chart-Pak, Inc., and Artype Inc., will print such artwork as symbols, title blocks, forms, and trademarks to meet the customer's specifications.

Labelon Tape Co. and Chart-Pak, Inc. manufacture pressure-sensitive, pre-printed tape with standard symbols such as walls, aisles, conveyors, center lines, stairways, and railroad tracks. Such tape is particularly useful for laying out floor plans because it can be stripped off repeatedly without leaving a mark or losing its adhesive quality.

When shading and cross-hatching are desirable, the draftsman can take advantage of Zip-A-Tone and Craftint overlays—long used by commercial artists. Appliques of this type are available in a number of textures for shading work, as well as in patterns to designate construction materials. Many overlays also are available in color for display purposes and for color-coding process diagrams.

Labelon Tape

CHANGES IN LAYOUT DRAWINGS ARE SIMPLIFIED BY USING PRINTED TAPE FOR STANDARD SYMBOLS.

Template Drafting

Layout work usually involves the elimination of several possible arrangements before a satisfactory solution is found. Templates, which can be positioned at will until the best layout is decided upon, offer a means of eliminating the time-consuming procedure of deleting portions of the drawing and sketching in the new arrangements. This system also should assist in arriving at the most efficient layout, since it permits the fullest utilization of trial-and-error methods.

An interesting example of the template process has been worked out by engineers at The Reliance Electric & Engineering Co. for use by their own draftsmen in laying out electrical circuits. Their templates are made by cementing photographic films of repetitive symbols on transparent plastic blocks. Each block contains a small permanent magnet to hold it in place when used in conjunction with a steel drawing board. The drawing paper is ordinary blueprint or whiteprint paper which has a relatively slow photosensitive coating, thus permitting its use with normal drafting room lighting.

The draftsman can move the templates around freely in order to determine the most satisfactory arrangement. After the templates are positioned, the assembly is exposed to photoflood lighting and the paper is developed. The draftsman then sketches in connecting lines to form a rough layout.

After the layout is approved, a finished tracing is made on photosensitive paper, again using templates for standard parts. The rough layout is placed underneath the paper to serve as a guide in placing the templates. A thin, transparent master image sheet bearing such standard notations and configurations as borders, title blocks, and outlined tables is placed over the paper. After it is exposed and developed, the final drawing is completed by inking in hook-up lines and completing the lettering.

A similar template process has been developed by Peerless Photo Products, Inc. for use in laying out floor plans. They recommend the use of special, white-surfaced aluminum layout plates having a ¼ in. printed grid. The floor plan is drawn on the plate, using a suitable scale. Overlays can be used to represent permanent plant features such as walls, bays, stairways, and columns. Scaled templates, representing such repetitive units as machine tools, conveyors, benches, and aisles, are drawn and inked on tracing cloth or vellum. These templates are photographically reproduced on plastic or heavy card stock in the quantities required. They are then cut out and positioned on the layout. Double-sided adhesive tape, which permits the templates to be

—Continued on page 68

The Manufacturers Life Building

. . . A New Concept for Comfort Conditioning

STAFF REPORT

WHEN THE MANUFACTURERS LIFE Insurance Company completed its new Head Office Building in Toronto in 1925, it was conceded to be well ahead of its time with respect to functional design. Incorporating clear floor spaces without columns, it proved equal to expansion needs of the business for nearly 20 years. Because artificial ventilation and lighting available in 1925 were far from satisfactory, the basic concept of the building's design was natural light and gravity ventilation.

With the completion of a new 11-story addition and renovation of the original structure, Manufacturers Life can again boast of a Head Office Building that is functional in the truest sense of the word, and incorporates the most modern concepts of office lighting and ventilation. When the architects and engineers were commissioned to design the new addition, which increases net floor area from 58,000 to 228,000 square feet, they were instructed to disregard the concept on which the original building was designed and to plan a truly modern building that would provide maximum flexibility of office arrangement, efficient operation, and low maintenance costs.

Structural Features

The new building has a structural steel frame with poured concrete floors. The floors incorporate a triple, steel underfloor duct system having preset inserts imbedded in the floor slabs to provide for telephone, signal, and electric convenience outlets.

Indiana limestone, which matches the original six-story structure, has been used for the exterior. Elevators and stairs are concentrated in a central

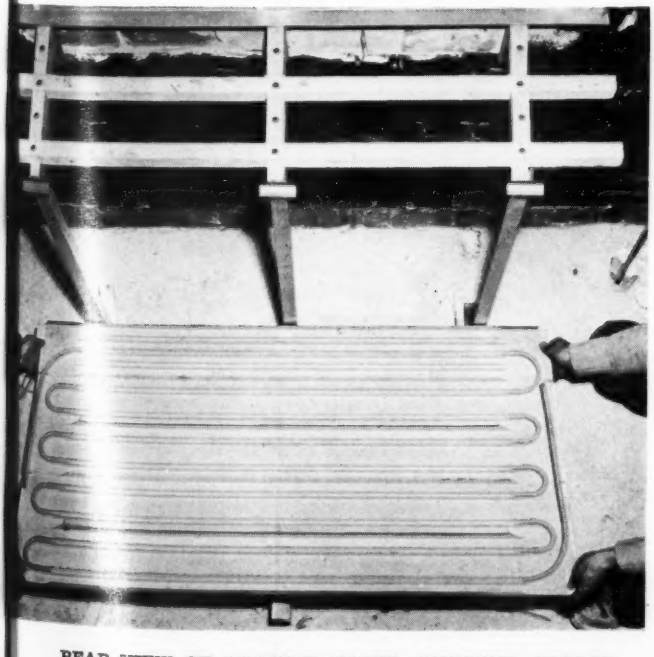
core, with 50-foot clear spans on three sides. To prevent construction noise from disturbing employees in the existing offices as well as people in the neighborhood, it was decided that the steel frame would be generally of welded construction.

Because of the growth nature of the life insurance business, office layout is subjected to continuous changes. A high degree of flexibility has been provided by using demountable steel partitions. The partitions are made in standard panels and can be easily taken down and re-erected, thus permitting re-arrangement of a department overnight. Three types of partitions are in use—ceiling height partitions which are 9-ft, 4-in. high; 7 ft, 3-in. high partitions; and a 3-ft, 6-in. high, steel rail type with a 1-ft, 6-in. glass panel on top. The first two types can be completely steel or have half their height in glass. Steel portions of the panels are filled with rock wool to dampen noise transmission.

All windows in the building have been designed to prevent condensation on the inside frames during cold weather. They consist of two sets of aluminum casements separated by wooden frames. Both the wood and the air space between serve as insulation. Gasket type weather stripping is used, and window fastenings are designed to maintain a tight pressure on the gaskets.

Window Panels

Heating and cooling are performed by extruded aluminum panels having copper tubes, through which water is circulated, imbedded in the back. The selection of this system was in part dictated by the desire to integrate the air conditioning of the old and new office buildings. In comparison to other methods, it has the least effect on steel design and requires the least amount of space.



REAR VIEW OF COOLING PANEL, SHOWING COPPER TUBING, PRIOR TO INSTALLATION UNDER WINDOW.

Structural Engineers
Wallace Carruthers & Associates, Ltd., Toronto

Electrical & Mechanical Engineers
Wiggs, Walford, Frost & Lindsay, Montreal, Toronto

Air Conditioning Consultant
Charles S. Leopold, Philadelphia

Architects
Marani & Morris, Toronto

Beneath each window there is an aluminum panel of sufficient heating capacity to prevent the formation of down-drafts at the window in cold weather and to compensate for direct radiation of heat from the room's occupants to the cold window. In addition to their prime function of heating, these panels are used for supplemental cooling in hot weather.

Temperature of the window panels, which varies between 62 and 140 F, is controlled by a thermocouple attached to the inner pane of a centrally located window on an intermediate floor. The thermocouple is shielded from the direct rays of the sun by a metal disc on the outside of the pane.

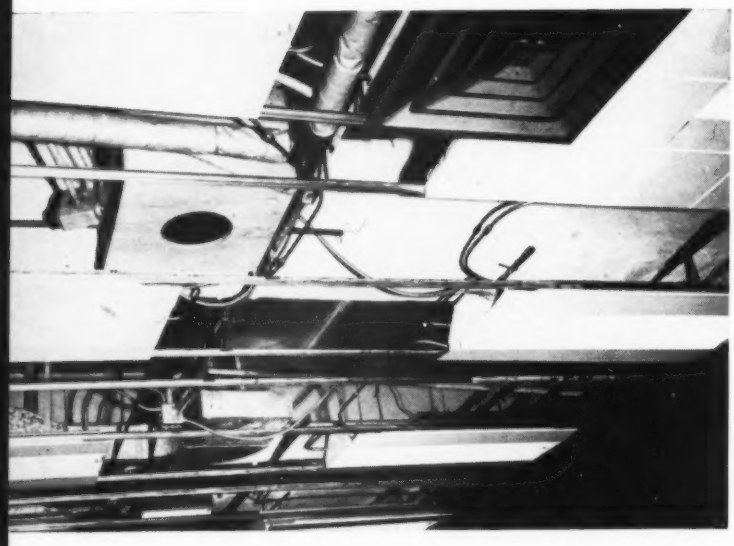
Ceiling

The ceiling is a suspended type made up of perforated steel panels and incorporating recessed troffer fluorescent lights, heating and cooling panels, and draftless diffusers for conditioned air supply. The steel panels are covered with sound absorbing pads, except immediately below loud speakers used for a public address system.

This type of ceiling permits all air ducts, wiring, piping, and loud speakers to be concealed, yet easily accessible. The recessed troffers, mostly six-foot units, are installed in rows on five-foot centers and spaced on ten-foot centers along the rows. The air diffusers are placed in line with and between the ends of the recessed troffers, giving a diffuser spacing of ten feet by ten feet.

A continuous bank of cooling panels, approximately three-feet wide, is installed around the outside perimeter of the ceilings. These panels are used primarily for cooling to compensate for solar radiation penetrating the windows. They also can be used to provide supplemental heating during extremely cold weather in order to avoid raising the temperature of the sill panels to a level which would not be comfortable to the occupants sitting close by.

All recessed troffers have water-cooled reflectors to absorb the heat emitted from the lamps and ballasts, and water-cooled flat ceiling extensions to



WATER-COOLED LIGHTING REFLECTORS AND EXTENSIONS ARE SEEN IN VIEW OF UNFINISHED CEILING.

absorb heat given off by the machines and the room's occupants. These panels operate on a cooling basis throughout the year. Temperature of the water varies from 62 F to room temperature. It is varied according to the number of lights in use by means of a lighting load compensator activated by a current transformer connected to one of the main lighting feeders.

Because of variations in demand for heating and cooling caused by outdoor conditions, the piping circuits for the sill and peripheral panels are divided into four zones each, according to exposure. Each circuit has its own circulating pump and a heat exchanger. The recessed troffer panels are treated as still another circuit.

Air Supply

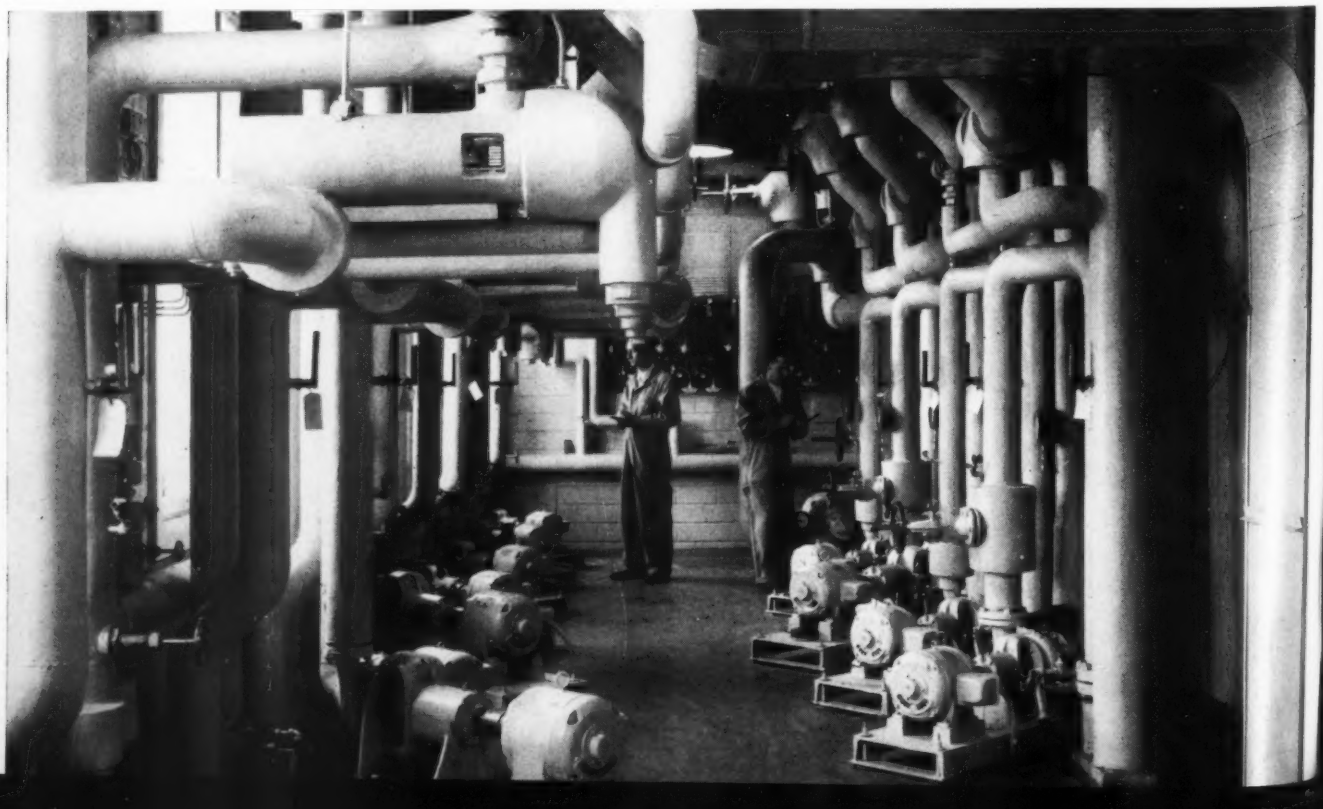
Although major heating and cooling requirements are accomplished by means of radiation and absorption, outside air must be circulated to provide necessary air changes and to control humidity. Because the function of the air flow is limited, the volume required is only about 40 percent of that required for conventional systems.

Fresh air is taken into the building through four central air conditioning units located in the machinery penthouse and in the sub-basement. In winter, the air passes through a bank of steam-heated preheaters. It is then mixed with recirculated air and passes through cleanable viscous filters and an electrostatic precipitator. Next it enters a two-bank air washer which not only further purifies the air but also cools the conditioned air in the summer and humidifies or dehumidifies it as required. The system will maintain approximately 45 percent relative humidity in the summer and 30 percent relative humidity in the winter.

On leaving the air washers, the air passes through a bank of initial reheaters through which a portion of the panel cooling water is circulated. This partially reheats the air and at the same time cools the panel cooling water. The air then passes through a bank of steam-heated reheaters which bring it up to a constant end temperature of approximately 60 F.

There are two principal systems for circulating air in office areas, divided roughly into the north and south half of the building. In addition, a

PANEL WATER CIRCULATING PUMPS, ONE FOR EACH INDEPENDENT CIRCUIT, ARE SHOWN IN EQUIPMENT ROOM.



THIS 800 TON CENTRIFUGAL REFRIGERATING UNIT, DRIVEN BY 700 HP MOTOR, CHILLS THE WATER FOR COOLING.

number of separate and distinct systems supply air for areas having special needs, such as the cafeteria, kitchens, lounge, basement, and sub-basement.

Air conditioning for private offices located on the tenth floor is generally the same as that used throughout the building except that booster heaters in the air ducts provide individual thermostatic control.

The entire panel heating and cooling system, as well as the conditioned air, is automatically controlled by an extensive control system. Except in a few special instances the controls are pneumatic. Recorder-controllers are used to assure efficient operation.

Cooling System

Water for the air conditioning system is chilled by a single 800 ton centrifugal refrigerating unit located in a service building behind the main building. An induced draft cooling tower for the refrigerating machine is located on the roof of this building.

Part of the chilled water is fed directly to cooling coils in the basement air conditioning units and the remainder to the dehumidifying air washers in the penthouse. The chilled water return from the penthouse is connected to a heat exchanger which serves to chill the water supply to the cooling panels. Before entering the heat exchanger, a portion of the panel water supply is partially cooled by the initial reheaters for the air supply.

Heating System

To provide steam for the heat exchangers used in the panel water system, and for the reheaters in the air supply system, a new low pressure, steam boiler plant has been installed in the service building. Three water-tube boilers, each having a continuous rating of 7500 pounds of steam per hour and operated at 30 psi, have been installed. Two of these units will supply sufficient steam for maximum heating conditions. Space also has been provided for two additional boilers when future building expansion is found necessary.

The boilers are equipped with fully automatic oil burners to burn heavy fuel oil. Two 10,000 gallon underground tanks are provided for storage of the heavy oil, and a smaller tank is provided to store light fuel oil. A single instrument and control panel has been installed for all boiler instruments, burner controls, and a number of indicating and recording instruments. A tunnel houses steam piping between the service building and the main building.

Conclusions

The concepts of panel cooling and heating, as applied in this building, were first developed in 1946 for a then-proposed 40-story office building to be built in New York City. A prototype of the system was installed in four rooms on the 32nd floor of the Time and Life Building in New York and, at the time when the method was recommended for the Manufacturers Life Building, it had been in operation for almost three years.

Although never before applied on such a large scale, the system offered a means of integrating the air conditioning of the old building with the new addition. Because of the structural obstacles presented in the old building, it provided some saving in initial cost over other systems considered.

In addition, this type of heating permits inside temperature changes of as much as six degrees in winter without noticeable effect upon human comfort. With air flow alone, a heating or cooling change of two degrees would produce noticeable effects. With relatively little air entering the offices, drafts also are minimized.

Contracts Clients Can Understand

CE exclusive

ARCHER W. RICHARDS, Executive Vice President
Designers for Industry, Inc.

Archer W. Richards has recently been elevated to Chairman of the Board of Designers for Industry, Inc. Previous to joining this firm in 1944, he held engineering, production, sales, and management positions in a number of diversified industries. Mr. Richards also spent a number of years as an industrial and management engineering consultant.

CONSULTING ENGINEERS provide such a wide variety of services that comparatively few organizations have a clear idea as to the true functions performed by consultants. In comparatively few instances is the service purely that of consultation. Consequently, unless consulting engineers are careful to develop the responsibilities for which they are being retained, situations might develop which could hinder the successful completion of their work.

With our firm, as consultants on planned product development, it has been necessary to develop a definite contract form and to carefully prepare a specification of the work to be accomplished so that no future misunderstanding detracts from our performance. This contract specifically sets out the

objective, and outlines the type of personnel required to carry it out. In addition it quotes the rates for each classification of personnel required.

Proposals

An estimated budget is prepared, based to some extent on past experience. It tabulates the estimated number of hours required by each type of personnel for each phase of the work to be accomplished. This budget not only gives the client an opportunity to analyze our understanding of the job to be undertaken, but also provides a clearer appreciation of the basis on which the budget was made. A lump sum estimate without such a breakdown is far more difficult for the client to understand.

When a project is properly outlined to indicate the time and cost of each phase, it reassures the client that he will have an opportunity to review the program at stated intervals and that he will be able to determine what the expenditure at any particular point might be. Design-development work cannot be set at a fixed fee because of inherent unknowns. However, the estimate can clearly define standard hourly rates for the types and levels of technical personnel to be employed on the project such as the project manager, senior engineer, project engineer, project designer, layout designer, draftsmen, and checker.

We have been able to operate within the original budget estimate on more than 90 percent of the projects undertaken. However, if for some reason the client is dissatisfied with the progress displayed on a project, he has the opportunity of cancelling at any time on reasonable notice. He therefore controls the project at all the various reporting stages.

Projected work should never be initiated until the client has approved the proposal. Each proposal should be carefully prepared and studied by management before submitting it to the client. If the terms meet with his approval, he should sign the proposal and return a properly witnessed signed copy to the consultant, thus setting up a contract.

In instances where the development is of a highly technical nature, preliminary authorization of expenditures may be obtained from the client. This authorization covers the technical survey which we recommend as the first phase of product development work. The results of technical surveys aid in firming-up the client's original specifications. At this point the client probably has not spent more than 10 to 15 percent of the total development cost, but he is thoroughly aware of the real objective. It may be that a revision of the subsequent budget will be required at this point.

Many clients prefer to authorize only the technical survey until results have indicated the economic soundness of the proposed development. The survey report may be followed by our recommendations that the project be dropped. Such a survey should be carried out by an impartial analytical group who will not be responsible for the further development work and therefore will not attempt to "freeze" their ideas.

Ethical Procedures

Once the foregoing requirements are satisfied, the development and design groups can start with a thorough understanding of the scope of the project and the end requirements. They are now at liberty to immediately utilize their talents in creative development and design execution.

It is imperative that all work be held in complete confidence. An agreement not to reveal any of the information or data handled by the contracting consultant should be included in the contract. Such an understanding is a necessity, since the consultant is being retained to create new processes and revolutionary methods for the client — not the whole industry. Disclosure of any part of the findings would destroy the client's time advantage.

This area of confidence should embrace all facets of a project. It should include not only patents, copyrights, and trademarks, but all ideas and techniques offered the client during the life of the project. We make it a practice, for example, of mentioning neither the client's name nor field of business when we contact suppliers and other information sources. Normally, the consulting engineer agrees not to re-employ the same techniques and methods for a future client until at least six months after the previous project has been ended.

The client should be protected patent-wise through an orderly and neat recording of all original and new developments. Each idea or suggestion should be recorded on special tracing paper, and typewritten reports covering all work accomplished should be submitted to the client either weekly or semi-weekly. These data are essential to the client's patent counsel. All such patentable devices should be assigned to the client at no extra charge.

The consultant should agree in writing not to hire the client's personnel during the period of the project and for six months thereafter. This is but common courtesy — yet it is frequently violated. It goes without saying that a client can hardly feel friendly toward a firm that lures away some of its top engineers. Such practices anger clients and besmirch the reputation of consulting engineers. In these times of engineering scarcity, it is all the more essential that "pirating" be avoided.

Client-Consultant Cooperation

Cooperation between the client and the consultant is extremely important. The consultant should work with, not outside, the client's organization. Total detachment might result in a product not easily identifiable with other products manufactured.

—Continued on page 70

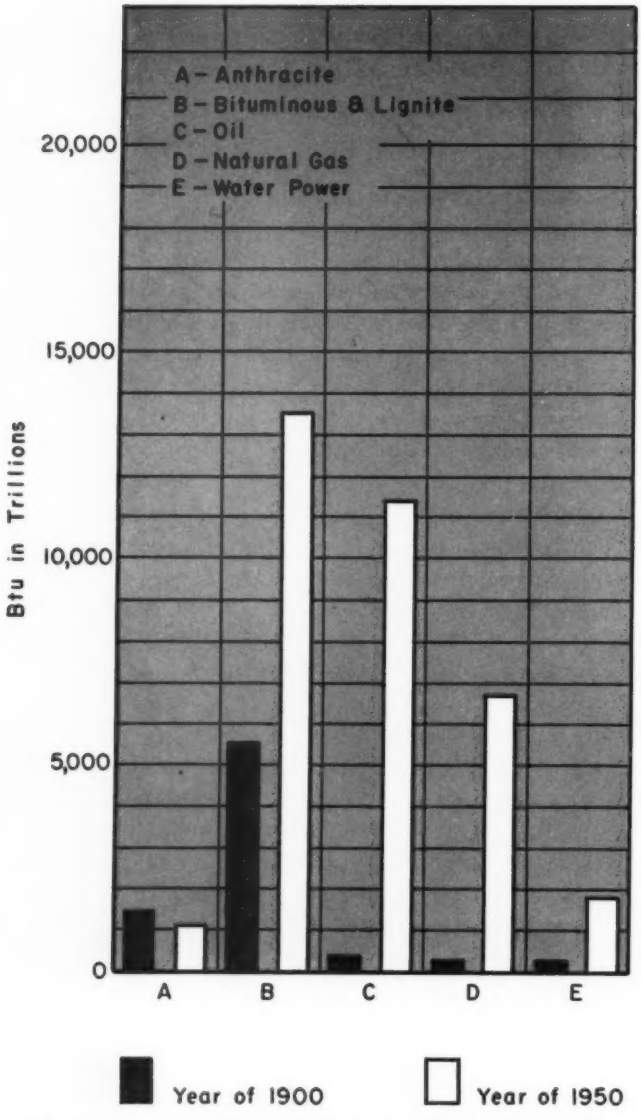


FIG. 1—TOTAL ANNUAL SUPPLY OF THERMAL ENERGY CONTRIBUTED BY MINERAL FUELS AND WATER POWER.

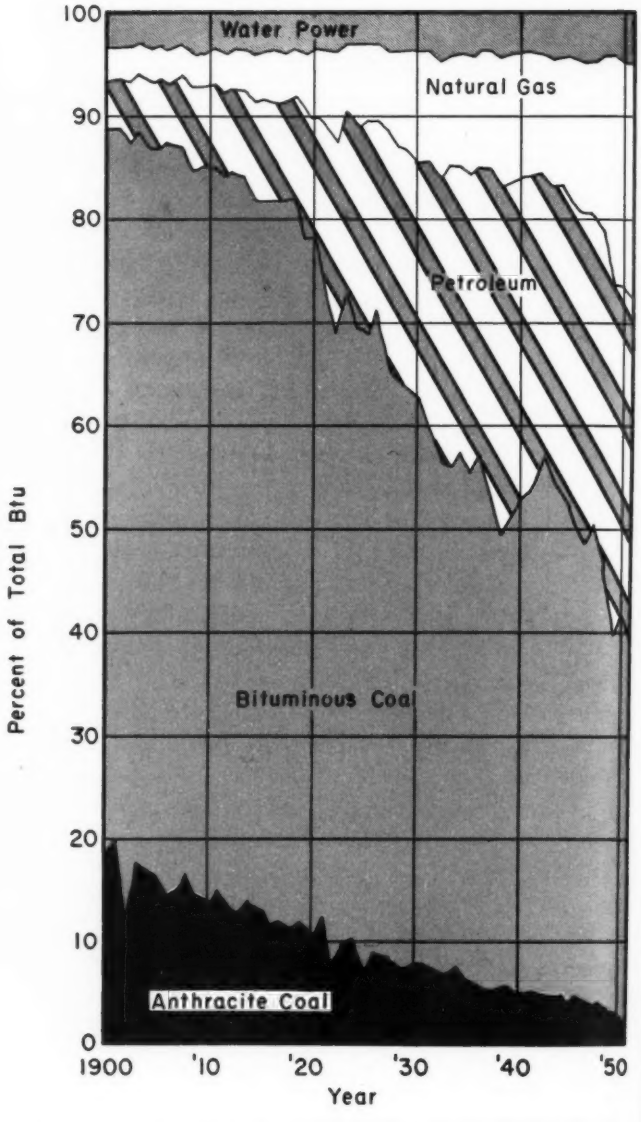


FIG. 2—UNITED STATES PERCENTAGE DISTRIBUTION OF ENERGY FROM MINERAL FUELS AND WATER POWER.

Changing Patterns of Fuels Consumption

WILLIAM S. MAJOR
Project Engineer
Machinery Division
Dravo Corp.

DURING THE PAST fifty years the annual supply of energy from mineral fuels and water power has increased nearly five times. In 1950 the total was 35,431 trillion Btu as compared to 7893 trillion Btu in 1900. Although coal, oil, natural gas, and water power all participated in this increase, there has been and continues to be a wide varation in the pattern of consumption for the respective sources of energy.

Fig. 1 shows the energy contributed by each of the fuels and water power for the two years cited. It will be noted that substantial growth was made by all fuels except anthracite. Bituminous coal and lignite, oil, natural gas, and water power all increased in the ratios of 1 to 2.44, 1 to 31, 1 to 27, and 1 to 6 respectively. Anthracite, however, decreased in the ratio of 1 to 0.77, dropping from about 1450 trillion Btu to 1120 trillion Btu.

When preparing Fig. 1, the following factors were

the basis for converting tons of coal, barrels of oil, and cubic feet of gas to the common denominator of British thermal units.

Fuel	Conversion factor
Anthracite	25,400,000 Btu per ton
Bituminous coal	26,200,000 Btu per ton
Petroleum, crude & products	5,800,000 Btu per bbl
Natural gas	1075 Btu per cu ft

Conversion of water power to equivalent fuel required to perform the same work was made by using the prevailing or average performance of all fuel-burning central electric stations for the respective years. In 1900 this figure was about 7 lb of coal per kwh, but by 1950 the rate had declined to 1.19 lb per kwh. This basis of conversion might be open to question since hydroelectric systems often displace steam installations where fuel is burned much less efficiently than in central stations. The ideal factor for converting water power into fuel equivalent would be the average efficiency of all forms of fuel consumption in each year. Obviously, there is no basis for establishing such an all-embracing average covering all the various types of fuel burning systems in use today.

Trend Reports

Reports of the Bureau of Mines provide the essential data for establishing the long time pattern or trend in energy demands. These reports cover annual supplies of energy from mineral fuels and water power in the United States on a common Btu basis. Fig. 2, showing a graphic presentation of such data on a percentage basis, clearly reveals that coal, petroleum, and natural gas all are continuing as major sources of energy. Fluid and gaseous fuels particularly are becoming increasingly important in present economy as indicated by the patterns of

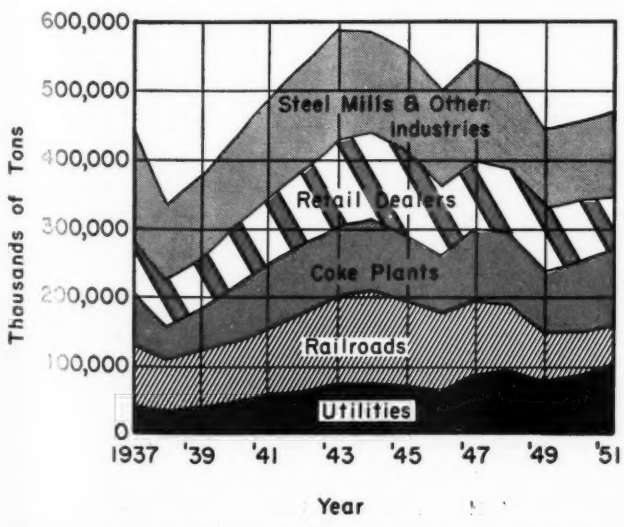


FIG. 3—ANNUAL CONSUMPTION OF BITUMINOUS COAL AND LIGNITE IN TONS BY FIVE MAJOR U. S. MARKETS.

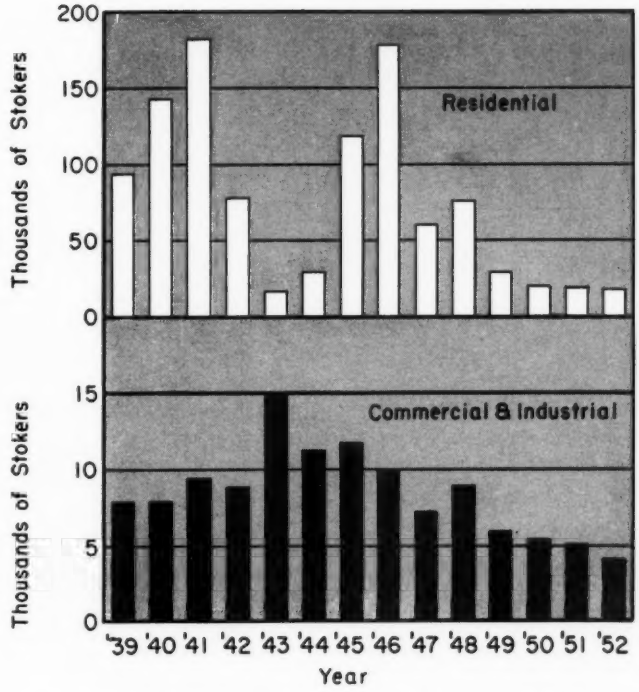


FIG. 4—TOTAL ANNUAL MECHANICAL STOKER SALES.

these two fuels. It is interesting to note, however, that the oil pattern was broken during the war years when coal was called upon to supply a high percentage of war-time energy demands.

Factors Influencing Consumption

Many factors influence the evolution of fuel patterns including: fuel prices, availability, reliability of supply, ash and/or fuel handling requirements, combustion characteristics, combustion efficiency, air pollution prevention, foreign oil imports, increasing residual fuel oil production, and expansion of long distance pipelines. Some of these factors stem primarily from other activities. For example, development of the internal combustion engine caused the subsequent high demands for gasoline and distillate oils. Producing these items results in large quantities of residuals. Although the amount of residual per gallon of crude oil varies, the economics of present refining processes generally dictate a relatively high by-product fuel percentage. However, some authorities believe new techniques will change this condition and residual oil should gradually disappear as a fuel except for certain services such as marine propulsion.

Principal Coal Markets

Consumption of bituminous and lignite coals by steel mills and other industries, retail dealers, coke plants, railroads, and utilities is shown on Fig. 3. This chart covers the latest 15 years for which full details are available. During this period the greatest changes in fuel consumption were taking place. Significantly, during the war years coal consump-

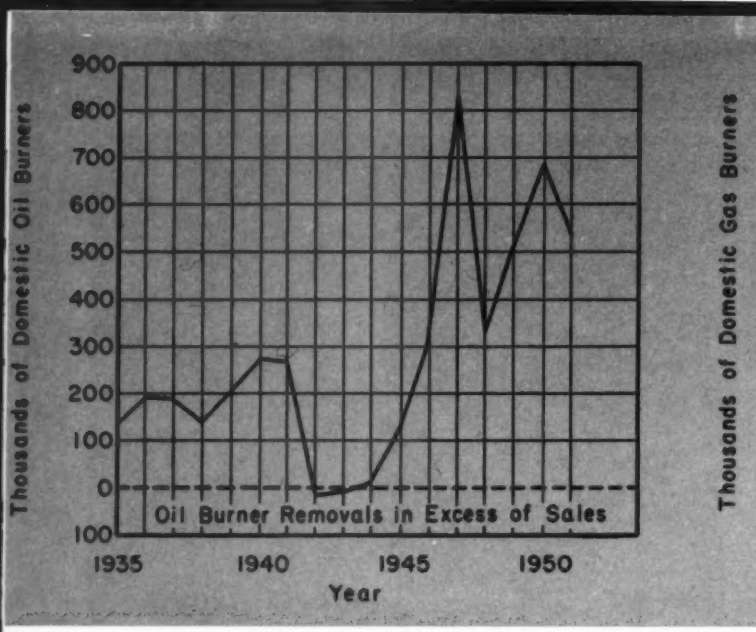


FIG. 5—ANNUAL SALES OF DOMESTIC OIL BURNERS LESS THE NUMBER OF UNITS SCRAPPED OR REMOVED.

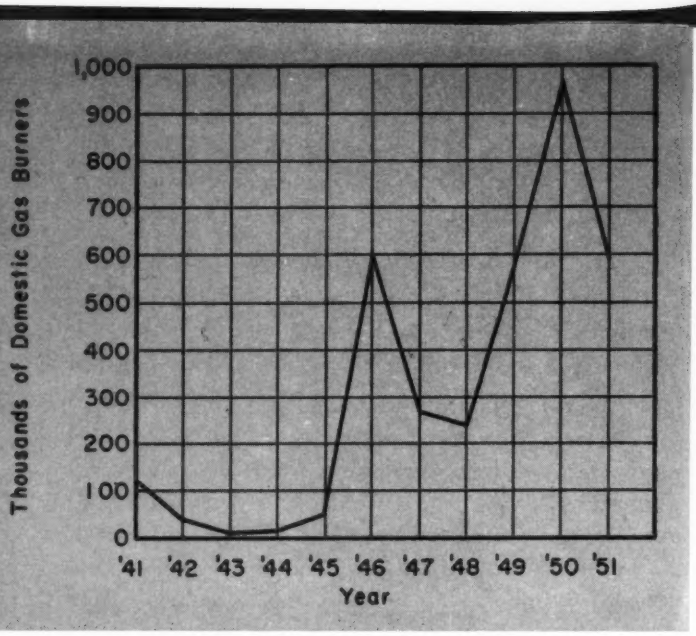


FIG. 6—ANNUAL SALES OF DOMESTIC GAS BURNERS LESS THE NUMBER OF UNITS SCRAPPED OR REMOVED.

tion by all classifications was heavy, but since then the trend has been downward. This is due primarily to substantially lower consumption by retail dealers and railroads, both markets having felt the inroads of natural gas and oil.

Retail Market

Since retail dealers primarily serve the residential and commercial markets, the drop in this outlet is more readily understood when sales of automatic fuel burning equipment for the past few years are analyzed. For example, Fig. 4 reveals mechanical stoker sales as reported by the U.S. Department of Commerce. Although sales in all stoker classes declined, the greatest drop took place in the residential classification. In contrast, Fig. 5 indicates the trends in domestic oil burner sales, less units scrapped or removed, for a period of 15 years. This chart discloses that while oil burner removals were in excess of sales during the early stages of the war, as soon as oil demands returned to normal domestic oil burners were again popular and sales reached new heights. At the same time, pipeline extensions brought natural gas to many sections of the country. This fuel's favorable price and excellent adaptability to automatic control caused further pronounced inroads in the coal home heating market. Fig. 6 shows the annual sales of domestic gas burners after deducting units scrapped or removed during the respective years.

This switch from coal to liquid and gaseous fuels for residential and commercial space heating is demonstrated by Fig. 7 which shows the percentage distribution of the respective fuel energies for 1935 and 1951. Current reports indicate this trend toward gas and oil as the most popular fuels for residential and commercial space heating will continue during the next few years. At the beginning of this year it has been estimated that there are a total of approximately 21 million centrally heated 1 and 2

TABLE 1 — LOCOMOTIVES IN SERVICE AND FUELS CONSUMED BY CLASS 1 RAILROADS

	Number of locomotives in service*			Fuel consumption, Btu in trillions		
Year	Steam	Electric	Diesel-Electric	Coal	Fuel oil	Diesel fuel
1940	40,041	858	797	2403.4	412.2	11.26
1941	39,624	857	1267	2818.7	510.4	16.53
1942	39,491	855	1667	3256.8	630.1	25.75
1943	39,725	868	2125	3491.5	730.7	32.08
1944	39,681	863	3049	3636.4	716.4	45.87
1945	38,853	842	3816	3254.5	707.9	62.98
1946	37,551	832	4441	2892.6	622.4	77.56
1947	35,108	821	5772	2970.3	611.7	111.04
1948	32,914	829	8089	2677.4	566.9	166.50
1949	28,964	817	10888	1753.3	399.2	212.91
1950	25,640	788	14047	1725.6	381.8	274.49
1951	21,747	780	17493	1463.9	343.7	341.52
1952	16,450	756	20480	1024.4	252.5	394.09

*Exclusive of approximately 20 units of other types

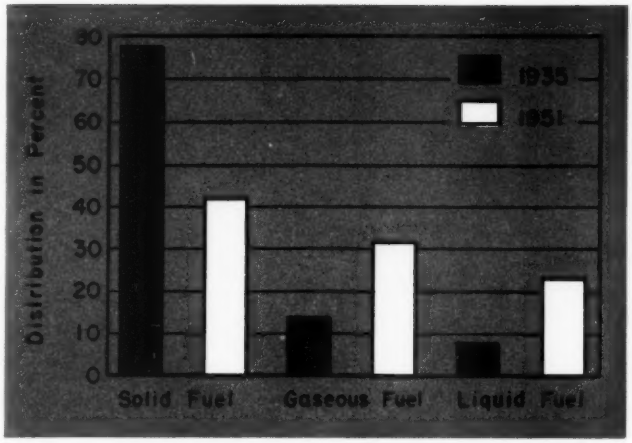


FIG. 7—MINERAL FUELS DISTRIBUTION IN PERCENT FOR RESIDENTIAL AND COMMERCIAL SPACE HEATING.

family houses, of which 43 percent use coal, 31 percent burn oil and 26 percent utilize gas.

Railroad Consumption

For several years prior to the war, railroads used from 80 to 100 million tons of coal per year, representing approximately 20 percent of the total coal consumption of the country. At the peak of the war effort annual railroad usage reached about 135 million tons, but since that time widespread application of diesel locomotives has caused a substantial decline in coal consumption. Many factors have contributed to this shift, the higher energy-system efficiency (steam locomotive is about 7 percent and diesel-electric is approximately 23 percent) of the diesel being the most important consideration. The ability of diesels to more readily conform with air pollution ordinances also has influenced the change in type of locomotives in service and fuels consumed by Class 1 railroads for the last 12 years as shown in Table 1. At the end of 1952, diesel-electric locomotives were handling 70 percent of gross freight ton miles, 73½ percent of passenger car miles, and 80 percent of yard switching hours.

Utility Systems

Growth of electric utility systems is providing an increasing demand for coal. In 1951, total annual generation was 370.7 billion kwh, or nearly ten times the 1920 production. Throughout this 30 year period, coal has been the leading source of heat energy as shown in Fig. 8. The impact on annual coal consumption would have been much greater if it had not been for the economy gains achieved by improved system designs in the past 50 years. Between 1900 and 1952, the average coal rate per kwh decreased from over 7 lb to 1.14 lb. Table 2 shows six modern plants that are operating at an over-all efficiency of less than 10,000 Btu per net kwh. In the near future, there will be more new reheat steam cycle plants in the same efficiency range.

Changes in coal rates per kwh and economy gains since 1919 are shown by the curves on Fig. 9. Because of this greater economy, only 105.7 million tons of coal were burned for generating 185.2 billion kwh in 1951 as compared to 31.6 million tons for generating 20.8 billion kwh in 1920. At present, it seems unlikely that equivalent gains can be accomplished as utility production expands to meet continuously increasing industrial, rural, and residential demands.

During the past six years, utility systems have experienced an average annual increase of approximately 1,800,000 residential customers. Furthermore, each customer used an average of nearly 150 additional kwh per year. This increased current consumption was the result of wider acceptance of household electrical appliances. The impact of appliance usage on annual kwh generation and equivalent fuel consumption is illustrated by Table 3. In reviewing this table, it is well to keep in mind that there are over 42 million residential and rural utility customers as of the beginning of this year. Over 85 percent of these customers store food in electric refrigerators, over 95 percent have radios, 10 percent cook on electric ranges, and about 60 percent use washers for their laundry. Other electrical appliances, like dishwashers, disposal units, automatic clothes dryers, and television sets are receiving in-

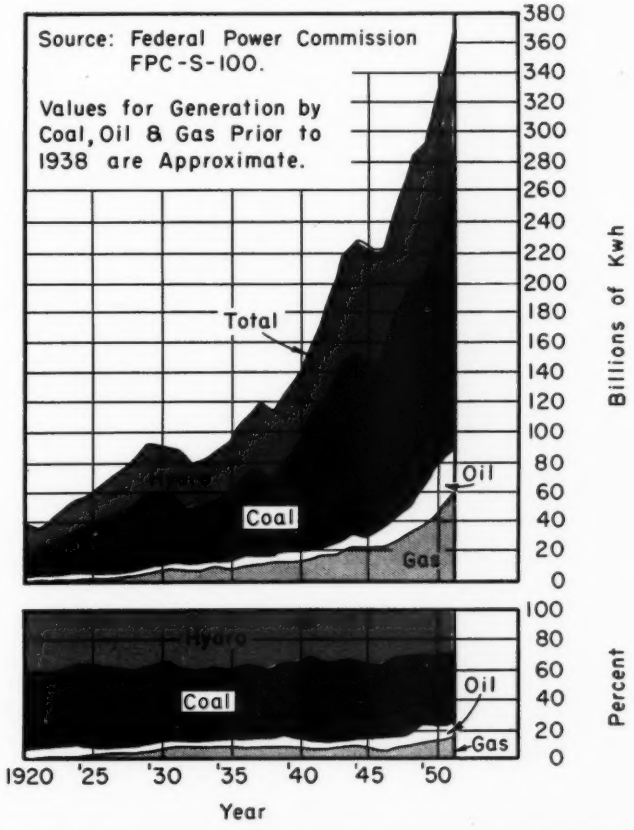


FIG. 8—PERCENT DISTRIBUTION OF TOTAL ELECTRIC UTILITY PLANT GENERATION BY SOURCE OF ENERGY.

TABLE 2 — UTILITY STATIONS WITH AVERAGE HEAT RATES UNDER 10,000 BTU PER NET KWH GENERATED

Name of utility	*Name of station*	*Btu per net kwh*
Indiana & Michigan Electric Co.	Tanners Creek	9354
Public Service Co. of New Hampshire	Schiller	9379
Niagara Mohawk Power Corp.	Dunkirk	9540
Duke Power Co.	W. S. Lee	9954
Metropolitan Edison Co.	Titus	9886
Appalachian Electric Power Co.	Philip Sporn	9418

creasing acceptance for existing and new residences.

Consumption of coal in coke plants continues as an important part of the solid fuels pattern. This market has grown from 74 million tons per year in 1937 to over 113 million in 1951. The increase is closely associated with the high level of steel production that has been progressively accelerated by the late war, post-war civilian demands, and the Korean situation.

Steel Mills and Other Industries

Coal also remains the basic source of energy for steel mills and many other industries. Utilization by this important market increased steadily from a total annual consumption of 110 million tons in 1938 to 165 million tons in 1943. While the general trend has been downward since the latter year, upward trends were noted in 1947 and 1951. Some industries have converted to oil or gas, but coal still is used for nearly 450 process operations such as heating, drying, cooking, and firing kilns. It also finds wide application for the smelting, refining, and shaping of metals.

How will future patterns of fuel consumption compare with current indicated trends? This is an interesting but difficult question to answer—one that will certainly bring forth diversified opinions. Even though present economy is being increasingly geared to fluid fuels, there is little if any factual data to indicate that the basic energy patterns of today will prevail in future years. All published studies on mineral fuels agree that available coal reserves are many, many times as great as known oil and natural gas supplies combined. Thus, coal eventually must satisfy most basic energy demands.

Atomic Energy

Atomic energy is one possibility that may introduce an entirely new and different fuel pattern in the future. Studies made by the Atomic Energy Commission indicate recoverable deposits of uranium and thorium have a heat energy potential approximately 23 times as great as that of the world's resources of coal, petroleum, and natural gas. Furthermore, four groups reporting to the Commission concurred in the belief that dual purpose reactors are feasible because plutonium credit would reduce the cost of power. Conversely, all supported the thought that no reactor could be constructed in the very near future which would be economical on the basis of power generation alone.

Opinions on Future Trends

When speculating on future fuel consumption patterns, it is interesting to consider the views of engineers, business statisticians, and research personnel affiliated with both solid and fluid fuels industries. Authorities in the oil industry feel that when petroleum supplies do become limited, the use of oil as an industrial fuel will decline rapidly, and

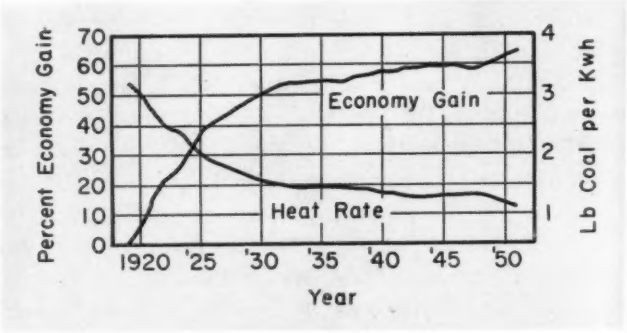


FIG. 9—TYPICAL ELECTRIC UTILITY STATION HEAT RATES IN LB PER KWH AND PERCENT ECONOMY GAIN.

it will be partially replaced by gas and coal. Next, petroleum stocks will be diverted from the domestic market so that maximum amounts of gasoline and diesel fuel can be produced. Further shortages of these latter fuels will be made up by conversion of coal. Gas, as long as it remains abundant, will take more of the industrial fuel load and will continue popular for domestic use. Shale oil's place in fuel patterns is still uncertain, but engineers anticipate that it will be used first as industrial fuel to replace the petroleum stocks diverted to gasoline production.

Another conception of future fuels consumption has been expressed by coal industry experts. This viewpoint visualizes the position of coal, petroleum products, natural gas, and water power when the 1951 energy load of 40.2 quadrillion Btu has doubled or reached 80.4 quadrillion Btu. When this occurs

the percentages of the respective mineral fuels will have changed as follows:

Annual energy load	40.2	80.4
Petroleum products	39.8%	44.7%
Natural gas	18.7%	22.4%
Water power	4.2%	4.2%
All coals	37.3%	28.7%
Total	100.0%	100.0%

In developing these percentages, many factors were considered including: (a) improvement in coal utilization by utilities, (b) drop in railroad markets with increased use of diesels, (c) higher coal requirements for general industry, (d) reduction in coal exports, and (e) greater coal demand by coke and steel industries. Analyses of these data indicate coal's annual participation would be 28.7 percent, which is equivalent to 880-million tons. It should be noted that the energy contribution from water power was arbitrarily doubled in direct proportion to the load.

One recent prediction indicates the manner in which the supply of distillate fuels may be provided over the next two decades. Shale oil production will start before 1960 and will reach 0.3 billion barrels annually in 1970. Coal conversion probably will start soon after 1960 and grow rapidly to 1.7 billion barrels per year by 1970. For domestic production, it is assumed that conversion of residual fuel will be under way before 1960 and virtually complete by 1970. Petroleum imports will probably increase to about 1.3 billion barrels around 1965 and then drop back to 0.8 billion barrels by 1970.

Although opinions differ as to when synthetic fuels from coal and oil shale will be needed, 1952 marked the eighth year of the Bureau of Mines synthetic fuels program. This activity and industrial research efforts have advanced technologically to the point where it is now possible to begin the design and construction of prototype plants. According to reports, these plants should be encouraged as the initial step in the development of a synthetic fuels industry. Furthermore, they would serve the following purposes: (a) provide a basis for future rapid expansion of the shale-oil and coal processes, (b) aid in conserving natural petroleum and reducing America's dependence on imports by hastening utilization of domestic raw materials for the production of liquid fuels, and (c) produce commercial amounts of chemical products at reasonable prices.

Assuming national economy continues to be closely dependent on fluid energy, there is every indication at present that long range supplies of oil and/or gas must be met by conversion of coal. The full potential impact of atomic energy developments is still a controversial subject. Numerous technical and economic factors must be solved before atomic energy will supplant mineral fuels in many sections of industrial activity.

TABLE 3 — DOMESTIC ELECTRIC APPLIANCE LOADS

Type of appliance	*Average annual kwh consumption**	*Equivalent tons of coal***
Range	1100	0.660
Refrigerator	300	0.180
Ironer	90	0.054
Washer	40	0.024
Iron	80	0.048
Vacuum cleaner	22	0.013
Radio	95	0.057
Clock	18	0.011
Dishwasher	30	0.018

*From Standard Handbook for Electrical Engineers
**Based on 1.2 lb of 13,100 Btu per lb coal per kwh

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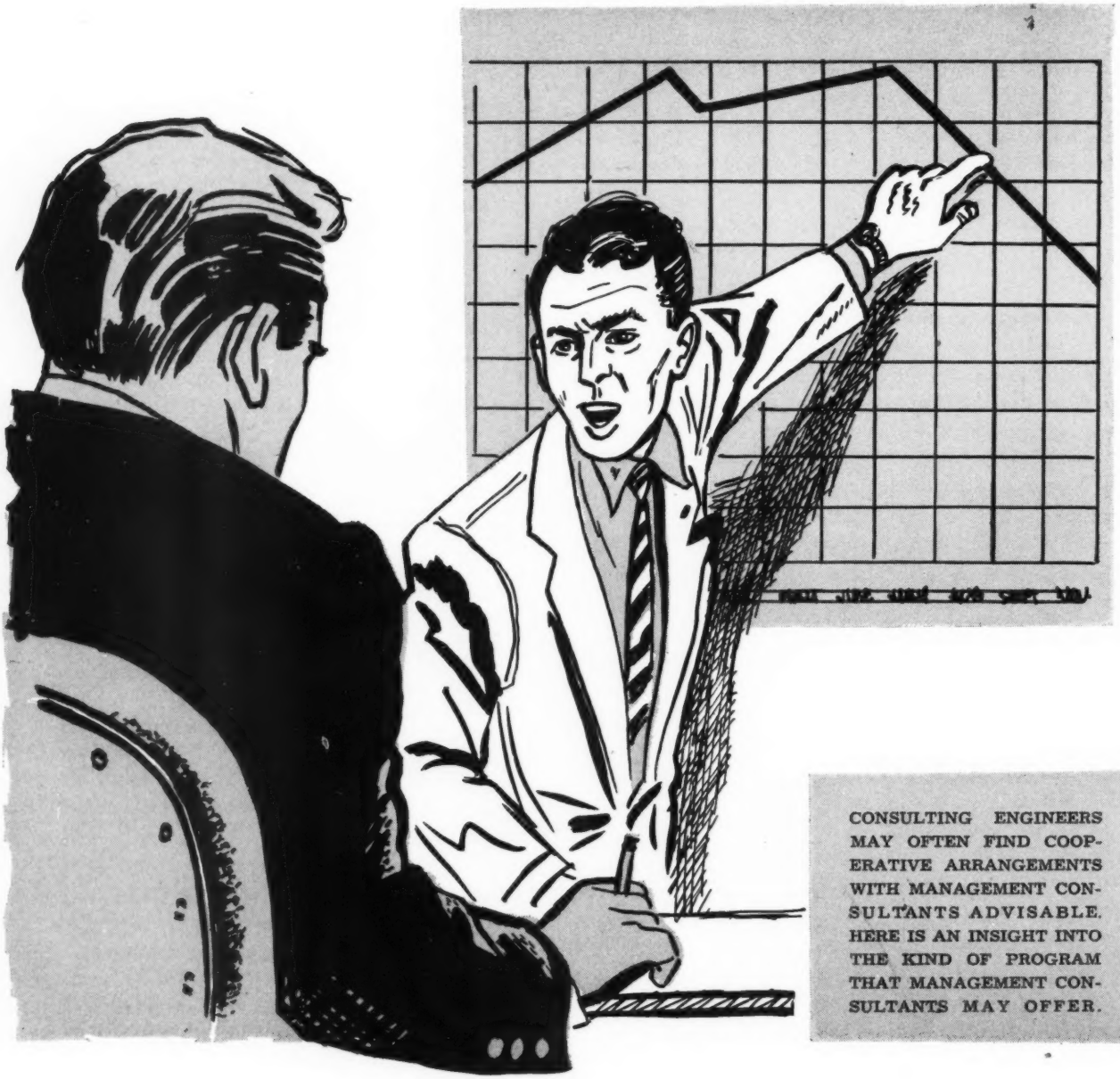


CONSULTING ENGINEERS MAY OFTEN FIND COOPERATIVE ARRANGEMENTS WITH MANAGEMENT CONSULTANTS ADVISABLE. HERE IS AN INSIGHT INTO THE KIND OF PROGRAM THAT MANAGEMENT CONSULTANTS MAY OFFER.

A Program for Management Consultants

CE exclusive

CARL HEYEL, P. E.
Associate Partner
George H. Elliot & Company

WITHOUT relinquishing their desire that the world return to peaceful pursuits, business executives are understandably concerned about the impact of the truce and eventual peace in Korea upon business in general, and upon their own operations in particular. However, as events have turned out thus far, most basic economic indicators have continued to register increases despite sharp declines and nervousness in the stock market.

Results since the resumption of truce talks last Spring have borne out the line taken by governmental officials in their psychological offensive against fears of depression. Cutbacks and cancellations have not been of sufficient magnitude to generate the type of a chain reaction that would lead to an old-fashioned slump. As a matter of fact, military spending for 1953-54 is scheduled at about the same level as for the fiscal year ending July 1, 1953, and will be slightly above that for fiscal 1952.

These evidences of the basic stability of our economy do not necessarily mean that a specific business will have smooth sailing. Individual industries are experiencing adjustments, and managements are being confronted daily with difficult problems. They must try to keep their own enter-

prises from being seriously hurt by the "minor dislocations and slide-offs" about which economists so flippantly generalize.

In a generally reassuring address last April, Secretary of the Treasury Humphrey said, ". . . . business activity in the United States in the immediate future is likely to continue at a high level. But regardless of international political developments, competition is becoming keener, margins of profit have been somewhat narrowed. . . ."

The word "somewhat" in the quotation will strike many as a painful understatement. Executives responsible for policy decisions are finding it necessary to keep closer control over operations than ever before. They are fighting harder for the sales dollar. Profit margins have been cut, and production costs must be kept in line. Break-even points in all industries are probably higher today than ever before. A sharp decline in sales, even if short, will prove extremely embarrassing for countless concerns.

All of this adds up to definite opportunities—and responsibilities—for management engineers. There are at least five specific areas in which the profession can render profitable service to its clients, thereby making an effective contribution to industrial stability in general. These areas for analysis and action should be attacked simultaneously. The order of listing does not imply that one should wait upon another. They represent a five-point program of action which should constitute management engineering's "theme song" for the coming months.

Activity-Unit Analysis

There should be a concentrated, hard-hitting examination into every activity of an enterprise, with special emphasis upon overhead and service units. There is a tendency, especially in larger organizations, for many activities to be created for a special need and then to be continued after the primary need no longer exists. In addition, units serving real needs have a tendency towards undirected growth.

"Activity-Unit Analysis," as conceived here, is an orderly, searching analysis into every identifiable unit within an organization, with the full co-operation of the unit-heads in charge. Its objectives are two-fold—to bring to light all opportunities for immediate economies in the way things are being done, especially in overhead items, and to outline in specific terms the type of long-run improvements that will insure maximum operating efficiency.

The first objective involves an analysis of manpower needs in relation to existing functions and output, as well as the development of all possible streamlining without sacrifice of essential services. The second objective involves an evaluation of existing organization and operations in the light of modern techniques and facilities, with specific recommendations as to the changes in organization, facilities, and procedures required to place the business as a whole on a competitive footing.

This sort of audit requires full backing from top management, thorough indoctrination and conditioning of the subordinate executive staff, and skillful handling of personnel questions.

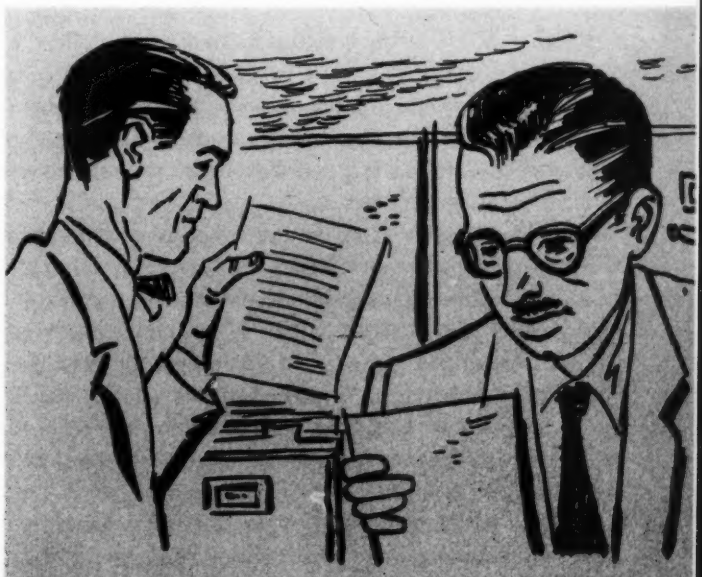
Direct Production Costs

As a rule, costs in the factory permit much closer analysis and control than expenses of selling and general administration. Firms applying the latest industrial engineering techniques coupled with soundly conceived systems of unit cost analysis can point to figures on production costs carried out to many decimal points of refinement, with variances showing up promptly for attention.

Firms that have not recently examined unit costs —especially piece-work rates or other incentive standards—will be surprised at the savings in direct labor costs which can be effected with full acceptance by the unions. These can amount to as high as 30 percent. Moreover, a modern incentive plan based on the "standard minute" immediately brings collateral advantages of methods improvement, better scheduling and routing, and related improvements in factory management. Too few managements seem to be aware of the possibilities here.

Eventual net cutbacks in military spending are bound to sharpen competition for the sales dollar. Few things are as definitely predictable as the fact that the seller's market, which has persisted in so many lines, will come to an end—to be replaced by a strong buyer's market.

The basic answer to this situation, in addition to



MANAGEMENT CONSULTANTS OFTEN FIND VALUABLE EXPERIENCE DATA CATALOGED IN FORGOTTEN FILES.

the obvious need for continuing market analysis, is intensified development of the sales force.

Economists have pointed out that our business boom has lasted, with minor interruptions, for twelve years. During these years an appreciable amount of the sharp edge of selling efficiency has been lost. The company that is quickest to step in with a revitalized program of sales selection and training will have the edge on competition. Therefore each company should have its markets and operations examined to determine the type of program which will best meet its particular needs.

Basic Programming

Amid preoccupations with what will happen in the future, every company should have someone sufficiently removed from current perplexities to permit a reasoned reflection on the direction in which the company should be heading in relation to the long-term outlook in the industry. He should consider the long-pull implications in the company's financial structure, the prospects for the products currently marketed, and the possible changes in consumer desires and buying habits.

In this respect, many companies are looking into the possibilities of product diversification — some going, at first glance, quite far afield. Thus an internationally known maker of carpeting and a large manufacturer in the railroad equipment field are both entering into the manufacture of products from reinforced plastics. (The reinforced plastics industry has been growing at the rate of some $25 million annually, posing a big long-term question mark to many industries.)

Facility Studies

Too often plans for expansion of production facilities are allowed to enter an advanced state without adequate underlying studies of markets, distribution, basic layout, and related industrial engineering matters. Early consideration of such problems should present costly corrective action later.

A thorough-going analysis of the general facilities situation should be undertaken, regardless of whether expansion is immediately contemplated. This should produce an over-all picture of how the company is set up with respect to its physical plant, how it compares with its industry, and what would confront it if expected growth continues. It will then be assured that all new moves will be part of an organized, well thought out pattern, designed to fit into a co-ordinated whole.

This analysis does not embrace all the possible factors worthy of consideration by management engineers. It is contended, however, that the five points do provide a line of attack which, if intelligently pursued, will help put any enterprise in a strong position to meet whatever the future holds.

Contractors Make Predictions

ABUNDANT WORK and intensified competition lie ahead according to a recently completed telegraph survey made by the Associated General Contractors of America among its membership. The survey gave the following outlook on a regional basis for the coming months:

New England — Highway and heavy construction work is the rosiest part of the picture for this area. A rise or maintenance of present rate is uniformly seen for highway work while 75 percent of the respondents see the same thing for heavy construction.

Middle Atlantic — Greatest increases are expected in heavy and building construction. A trend toward more commercial work and less industrial construction is predicted.

South — Increases are seen for highways and heavy work and also for school and commercial construction. Industrial and residential work is diminishing.

Middle West — Building is expected to stay at present levels. Highway work will take an upturn and heavy construction work will drop off. A shift is expected to commercial and school work.

Southwest — Increases in all categories are expected.

Rocky Mountain — Building, highway and heavy construction are all expected to increase.

Far West — This area presents the most fluid situation of all. A sharp rise is expected in highway work and substantial declines are seen for building and heavy work.

Over-all, the guess was that there would be more work in all three major fields of construction — building, highway, and heavy. The greatest gains are expected in highway work, the smallest in building work. The most significant trends predicted were the declines in industrial and residential construction and the gains in school and commercial work. Public works are expected to shift from federal to state, county, and municipal contracts.

THIS FULLY AUTOMATIC PLATING MACHINE IS THE HEART OF UNION SWITCH AND SIGNAL'S NEW PLATING PLANT.

Planning a New Plant

ALBERT BESWICK
Works Manager, Union Switch and Signal Division, Westinghouse Air Brake Co.

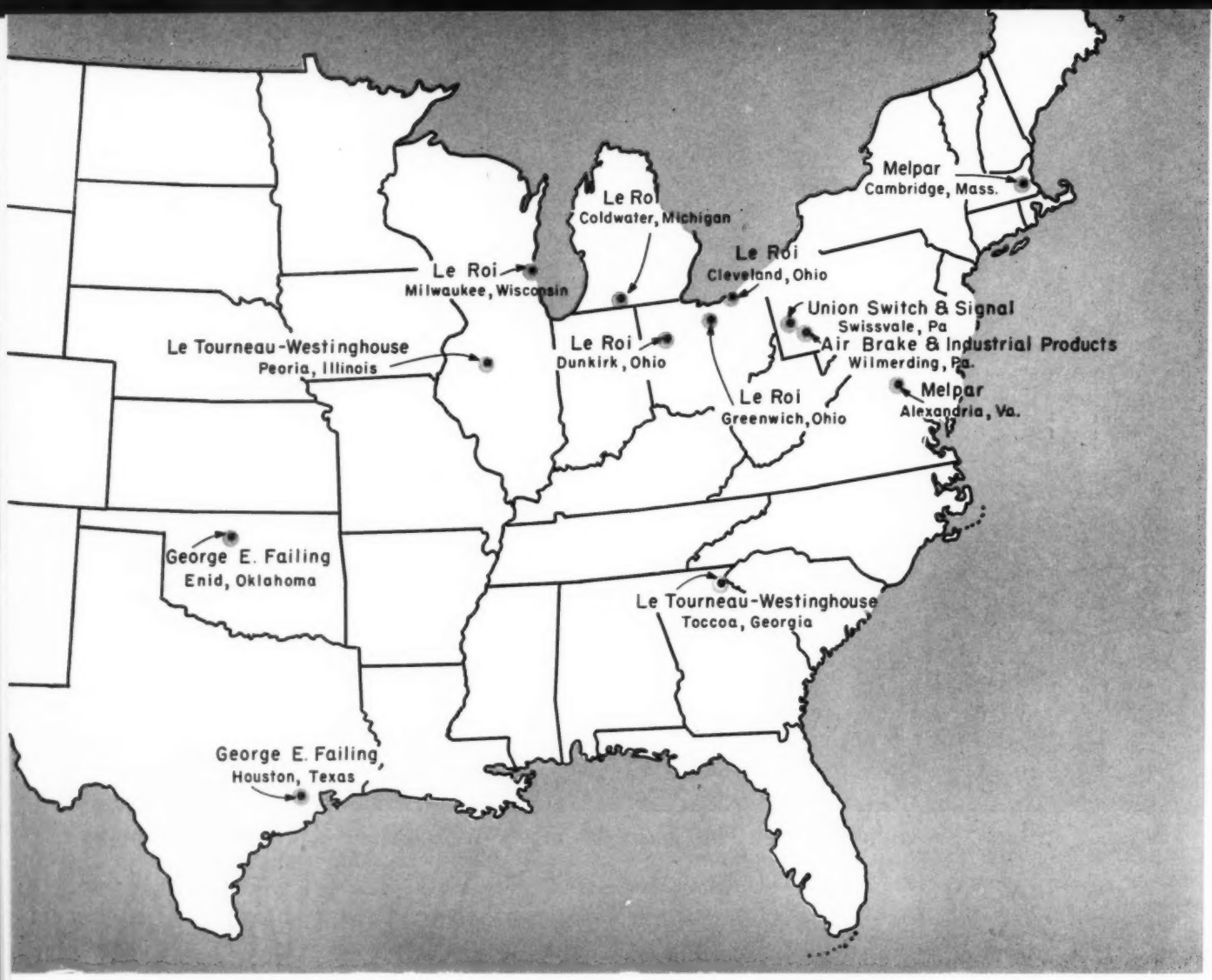
RECENTLY, one of the many engineers who have visited the new electroplating plant of Union Switch and Signal remarked, "Yours is probably the most complete job-plating shop in the nation."

Whether it is or not is a matter of conjecture. Union Switch and Signal believes only that it is complete because it fulfills the purposes for which it was built. When first planning the building, the aim was to build an installation that would—as cheaply as possible—coordinate plating facilities for the then-existent Westinghouse Air Brake Company units: Melpar, Inc., the Air Brake and Industrial Products divisions, and Union Switch and Signal. At the same time, relief was sought from prohibitive maintenance costs accumulating in the former plating department.

In a sense, it was the latter condition that eventually caused action in the direction of a new plant; when maintenance costs reached as high as $7000 per month at the old plating facilities, it was decided to go ahead with plans for a coordinated installation to serve the needs of all the company's divisions. Taking on the plating work from the newly added subsidiaries (the Le Roi, George E. Failing, and Le Tourneau-Westinghouse companies) was decided later and did not directly enter into original plans for the new plant.

Commercial Plating

Thinking began in terms of commercial plating when suppliers—the Hanson-Van Winkle-Munning Co. and the Udylite Corp.—said that the planned facilities would result in a concentration of plating equipment that could not be found anywhere else. Detailed studies were made of the commercial plating facilities available to the many industries in



MANY OF THE SCATTERED PLANTS OF THE PARENT COMPANY ARE SERVED FROM THE NEW SWISSVALE PLANT.

the Pittsburgh area. These studies determined the extent of the need for additional facilities. In the cases of the subsidiaries (whose plants are located in such scattered areas as Toccoa, Ga., Enid, Okla., Milwaukee, Wis., and Peoria, Ill.) transportation costs were compared to cost savings in determining where such plating work should be done.

For example, a great deal of plating work for Le Roi Co.'s Rock Drill division in Cleveland, O. is scheduled for the new Swissvale (Pittsburgh) plant. Because of the short distance, savings in plating cost in the new plant will offset the freight costs.

What is in the new plant? The equipment includes a full-automatic cadmium plater, three semi-automatics working in conjunction with the full-automatic, five barrel-plating lines, a nickel-over-copper-flash full-automatic, and complete still-plating facilities. The latter include specialized treatments such as iriditing, anodizing, parkerizing, and bonderizing. Plating metals are cadmium, copper, tin, zinc, nickel, chrome, gold, and silver.

Most important from the standpoint of maintenance costs is that the building was designed—from the foundation up—to withstand the thermal shocks and corrosion that any plating installation has to undergo. So far this year, with the plant in operation at 40 percent capacity for only eight months, approximately $50,000 will be saved in maintenance and personnel costs; next year the savings should be $150,000. The cost of the building and equipment is expected to be realized in a very few years.

What was available previously? On the fifth floor of one of the existing manufacturing buildings, the plating department grew up in a fashion to which no overall planning had been devoted. Equipment—mostly still and some barrel—was added as the particular need for it arose. Personnel were classified in five rate categories depending on individual skills.

With the exception of some large items, all US and S work was performed there; the Air Brake and Industrial Products divisions sent the majority of their work to commercial platers.

When planning the new installation, six major items were covered: location, equipment to be installed, building construction, sewage and sanitation, ventilation, and personnel.

Considering the location, the US and S plant was

chosen because it not only had room for the new building, but also had room for future expansion. In addition, selection was based on the following factors: first, most of the items to be plated were of US and S manufacture; and second, the US and S plant is ideally situated along the main line of the Pennsylvania Railroad. It is only a short distance from U.S. Route 30 leading to Wilmerding, where the Air Brake and Industrial Products divisions have their plants.

Inter-plant materials handling under this arrangement presented no problem because an inter-plant transportation system already existed and facilitated transfer of items among the three divisions. Schedules were expanded to handle the increased flow of materials.

Site Terrain

The Pittsburgh area is known for its hilly characteristics. Westward from the Pennsylvania Railroad the ground is relatively level for some 2000 feet. From then on, however, there is a sharp drop of some 60 feet, after which the area again levels out. Some of this space had to be used for the new building in order to provide for the possibility of future expansion.

To maintain the established building level, the needed space was filled with some 4500 tons of dirt and granulated slag; pilings were driven 30 to 50 feet deep to provide a firm foundation.

Before final decisions were made concerning the building or its equipment, several US and S men toured plating installations throughout the nation. They noted what equipment others had and what they were doing to combat corrosion, health hazards, and so forth. These men spent the greater part of eight months on this phase of the project.

Equipment Requirements

To understand why it was felt necessary to install all the equipment mentioned, consider the principal items produced by Westinghouse Air Brake and its subsidiaries. US and S manufactures equipment for use in electric and electro-pneumatic systems such as route interlocking, car retarder speed control, automatic switching, centralized traffic control, coded track circuit control, and train communications.

Similarly, the Air Brake division devotes most of its production to railroad supplies. The Industrial Products division is concerned with equipment intended for oil, maritime, and other diversified industries. Melpar, strictly speaking, is a huge electronic research and development laboratory for the company. The others (Le Tourneau-Westinghouse,

VISITORS OFTEN COMMENT ON THE FACILITIES AND ON THE LABORATORY-LIKE ATMOSPHERE OF THE PLANT.

George E. Failing, and Le Roi) produce such items as earth-moving equipment, portable oil drilling rigs, portable compressors, and pneumatic tools.

Most, if not all, of these products are continually exposed to the weather or other corrosive elements; a great majority must operate on a "fail-safe" principle. This is the primary reason for the great variety of plating metals to be found in the plating shop. Specifications in various national defense contracts also played an important role in the decisions.

Expansion Effects

The parent company's expansion and diversification program, instituted in 1951, determined the theme for the building—job-lot plating on a mass-production basis. Production schedules, excluding commercial plating, were large enough to warrant thinking in terms of installing three full-automatics for the plating of cadmium, tin, and copper. It was decided, however, to install but one (cadmium), making it the key machine in the production runs.

The cadmium automatic was modified by adding a third rack to the regular two and enlarging the nine tanks in its cleaning line. All items slated for full- or semi-automatic production runs are cleaned on the full-automatic machine. Those going to the nearby semi-automatics are removed from the outer rack at the ninth tank. The outer rack then proceeds unloaded through the remaining steps of the full-automatic cycle.

The other, smaller full-automatic (nickel over copper-flash) plater was ordered specifically for the plating of relay contact springs. Previously, these small springs had to be wired separately for still plating. By installing the machine and designing special racks for the handling of the springs, additional savings in man-hours were made.

As far as possible, modern conveyor systems have been installed throughout the plating areas of the plant to facilitate transfers of materials. At the main entrance, a hydraulic lift is provided to unload trucks. The operator of a fork-lift, for example, works directly from the bed of the truck being unloaded.

Once the nature of the equipment was determined and its placement in the building area (90 feet wide and 200 feet long) was decided, building planning began. With the help of the contractor, the John F. Casey Co., Pittsburgh, every effort was made to make it as damage-proof as possible. Working and cleaning areas were covered with corrosion-proof brick; the binding cement was selected according to the area in which it was to be used. A tank containing muriatic acid, for example, has a binding cement under it especially compounded to neutralize this acid.

Ventilation and Heating

The ventilation and heating system was designed to circulate, replace, and heat a maximum of 300,000 cubic feet of air per minute. General ventilating fans remove half the air; the other half is removed by individual exhausts of the downdraft-updraft exhaust system. The downdraft-updraft system draws off vapors at the surfaces of fluids in the plating tanks. The vapors do not affect the operator since they are drawn off immediately above the liquid levels and are pulled down into underfloor ducts. Here the vapors condense and flow away.

Air louvers, complete with finned heating coils, are located in the north and south walls. Dual-control thermostats are installed to heat the building properly and to protect the coils from freezing. These thermostats restore steam flow when outside temperatures drop below a certain level regardless of the inside temperature. During the day the heating units use exhaust steam from the nearby forge shop; during the night, live steam supplied from the power house is used.

At the present time, building wastes meet every specification of the Sanitary Water Board, Pennsylvania State Department of Health, and the Allegheny County Sanitary Authority. The latter believes that its interceptors can handle any current wastes. In the event it ever decides otherwise, provisions have already been made in the sewer system to construct an underground holding tank where wastes may be treated and stored for eventual disposal.

Building Construction

The building itself is of steel frame and rafter-like construction. Because of the planned overhead loads, trusses were not included since the vast amount of steel involved would not have been justified. When the final plans were drawn up, they included provisions for the overhead mounting of rectifiers so that each piece of equipment would have an independent source of power, a source that would not consume valuable floor space. These rectifiers are mounted on I-beams connected to the steel columns.

Rectifiers were chosen because they involve less maintenance and less initial cost. Motor-generators would not have easily fitted in with the plans to mount power supply units overhead. Some motor-generators, though, do supply electric power to still-plating units.

Personnel Factors

It was realized at the very beginning that the plans called for an installation employing less personnel than the old. Consequently, an early agreement was reached with the union as to procedures which would be followed.

The principal approach was to interest specific personnel in the idea of transferring to other jobs when they were not particularly suited to mass-production work. With few exceptions, the employees responded enthusiastically to this treatment and were rewarded with jobs equal to or better—from the standpoint

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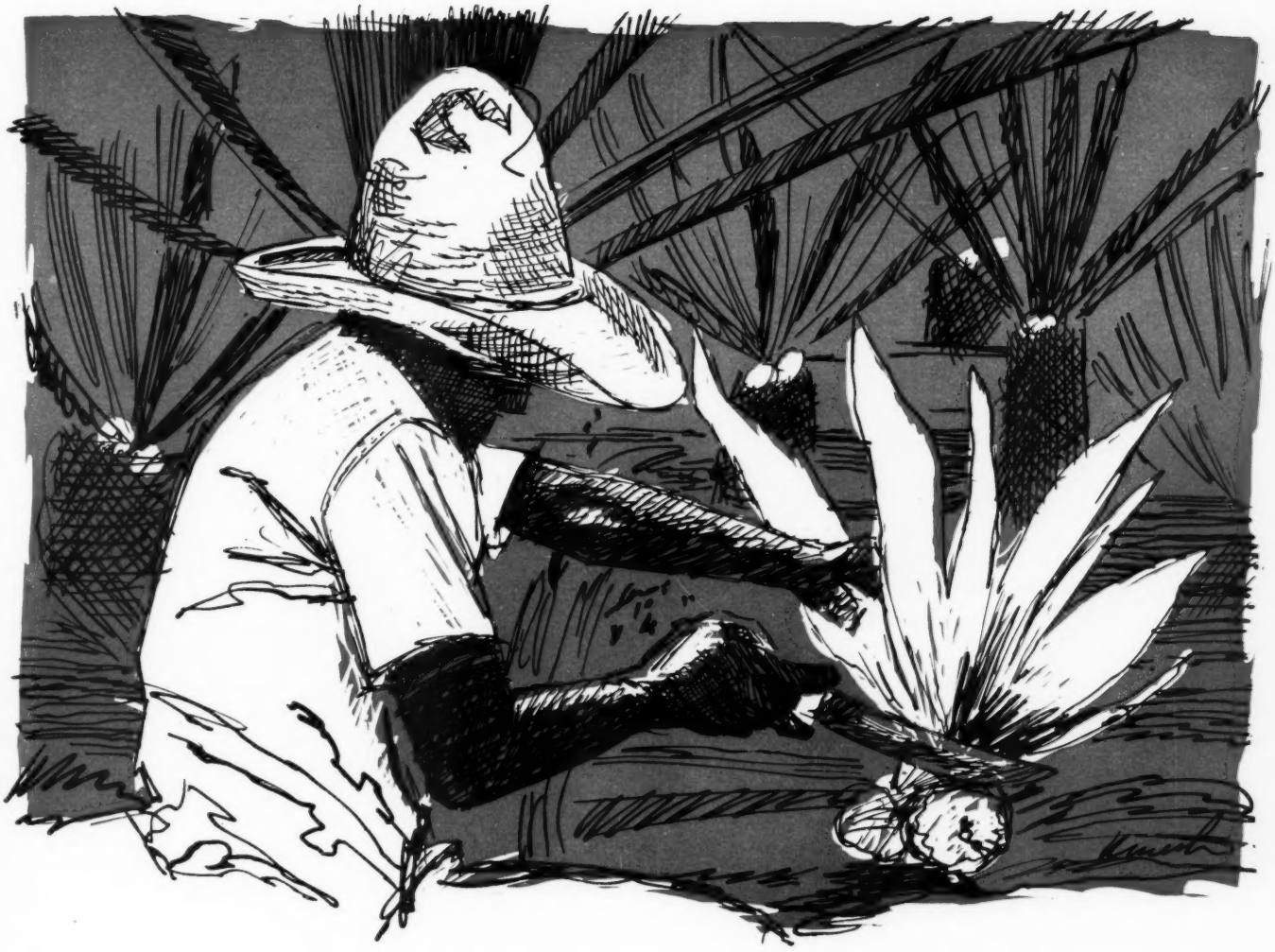


WHILE HENEQUEN FIBER IS PRIMARILY USED FOR ROPE, BY-PRODUCTS RESEARCH HAS YIELDED A VALUABLE WAX.

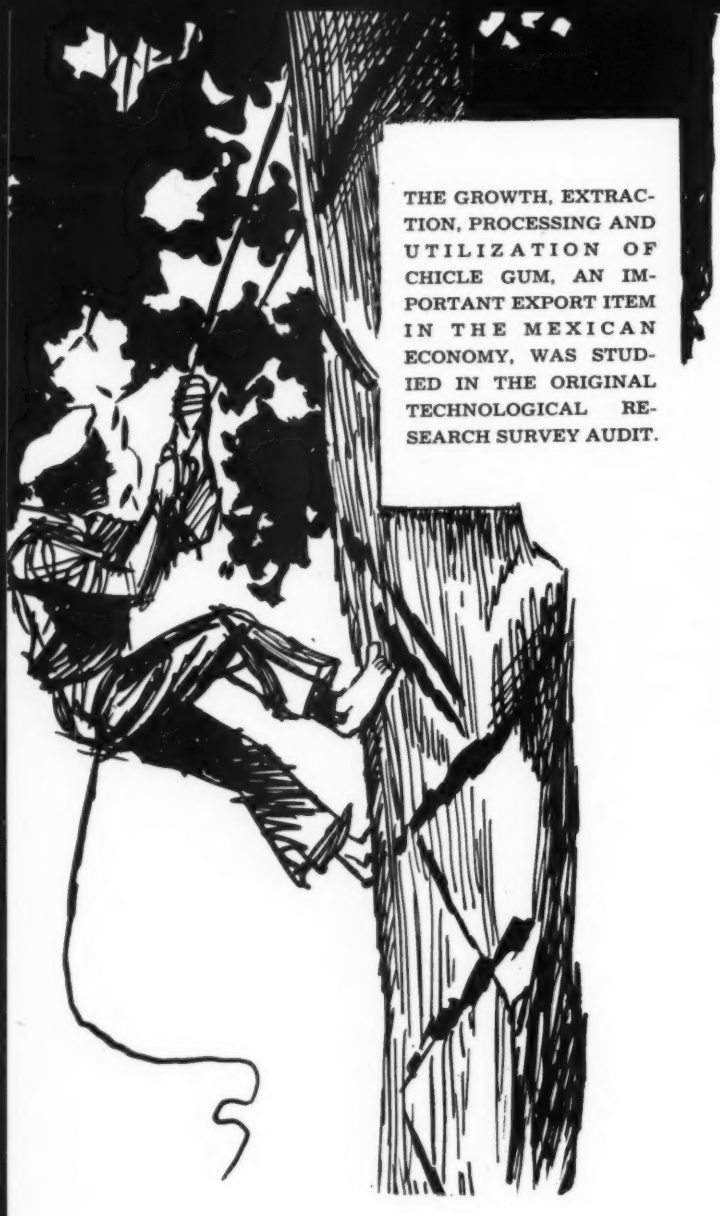
Industrial Research Helps Mexico

THOMAS P. COLLIER
Manager, International Division
Armour Research Foundation

Thomas P. Collier is a CE graduate from the Illinois Institute. His background in international trade and engineering was as a resident foreign representative in Latin America and as a general manager of export operations. Since 1951, Mr. Collier has directed the international work of the Foundation.

The International Division is a department of the Armour Research Foundation concerned with the technical and economic development of foreign countries through the application of sponsored industrial research programs. This is a preliminary step towards the full-scale utilization of the potential resources, products, and markets by private and government interests.

TO PROMOTE A PROGRESSIVE PROGRAM of industrialization in Mexico, Senor Eduardo Villasenor, director general of the Banco de Mexico, requested the Armour Research Foundation to car-



THE GROWTH, EXTRACTION, PROCESSING AND UTILIZATION OF CHICLE GUM, AN IMPORTANT EXPORT ITEM IN THE MEXICAN ECONOMY, WAS STUDIED IN THE ORIGINAL TECHNOLOGICAL RESEARCH SURVEY AUDIT.

ry out a nation-wide technological audit. Organized and conducted jointly by the United States and Mexican technologists, this audit reached into the major areas of Mexican industrial activities.

Technological auditing is a critical survey of existing and potential resources, needs and markets. The long-term goals are to improve the economy of the Mexican nation and its people. The immediate aims of the audit were:

1. To examine and evaluate the technological status of Mexican industries and related operations.

2. To find specific ways in which existing phases of these Mexican industries could be aided through the application of modern industrial technology and to propose methods for making this technology available in comprehensive form.

3. To propose additional new industries which could feasibly be established in the Republic.

4. To discover specific methods in which scientific research can be applied to the solution of problems which can stand as barriers to Mexican industrial development or which may endanger the retention of markets for Mexican products.

When the field work began in November 1944, the Foundation established an office and survey headquarters in Mexico City. A permanent technical staff was sent to this office from the Chicago laboratories to cooperate with a team of Mexican economists, engineers, and other technical personnel. However, the work of the field staff was supplemented by the consultation and laboratory services of the entire Chicago staff.

During the initial phases of the audit, basic data were organized, preliminary interviews held, and inspection trips conducted in the Federal District. Travel routes were laid out through the principal areas of Mexico including the main cities, manufacturing zones, agricultural areas, and regions of potential development and growth.

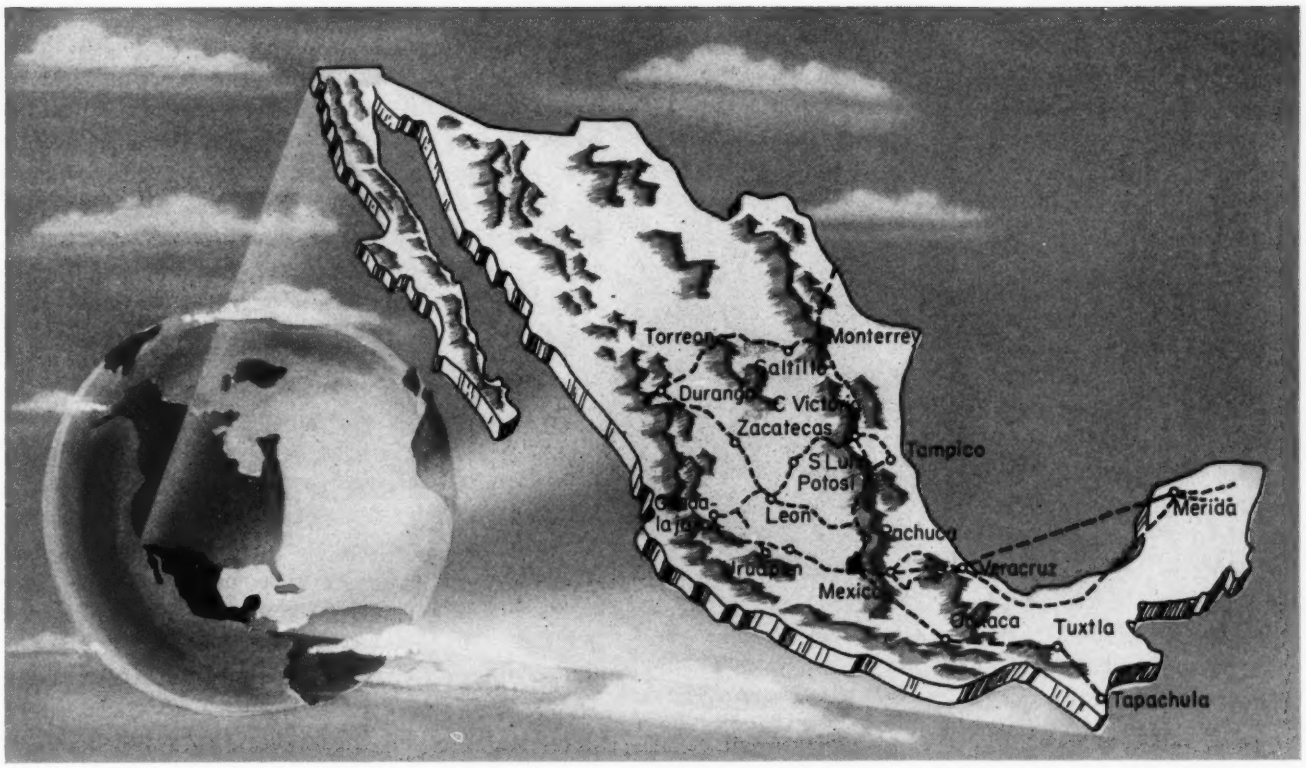
Factories, agricultural projects, universities, trade schools, laboratories, and other commercial enterprises were visited in the course of the field work. These observations were supplemented by discussions and interviews with industrial executives, government officials, bankers, educators, exporters and importers, factory workers, farmers, students, and private citizens representing varied interests. When necessary, on-the-spot laboratory tests were made. All findings were then assembled and coordinated in the Mexican field headquarters.

Specific recommendations and suggestions in the completed audit resulted in the initiation of an immediate program of laboratory research and development towards the industrialization of the following resources: henequen wax and henequen by-products, casialote tannin, and coal. The domestic production of oils was studied with regard to leather treatment, soaps, paints, and new sources of edible oils, among others.

The henequen by-products research may prove especially valuable in Mexican economic life. After the fiber used for rope was removed, the waste pulp was found to yield a wax with properties similar to the widely used Brazilian carnauba wax. This new henequen by-product has been valued at $20 million annually in exports to the United States alone, well justifying the research.

When a project suggested by the audit was successfully completed, additional projects were started. These included the development of a new tortilla flour, a survey of Mexico's fluorspar resources, a study of the domestic utilization of meat by-products, and investigations of vegetable oils, charcoal substitutes, and cellulose materials. As private Mexican industry became cognizant of research activities available to them, they too came for technical services on glass, textiles, maguey products, salts, vitamins, and corn products.

A further stimulus to technological advancement in Mexico was the Mexican-American Conference on Industrial Research in October 1945. This conference was held in Chicago and was attended by representatives of government, banking, research,



WITH MEXICO CITY AS HEADQUARTERS, TRAVEL ROUTES FOR THE FIELD INVESTIGATIONS WERE LAID OUT (AS SHOWN) TO COVER THE PRINCIPAL CITIES, CURRENT AND POTENTIAL MANUFACTURING ZONES, AGRICULTURAL AREAS.

industry, and commerce of both nations. The purpose of the Conference was principally for the discussion of mutual problems and the exchange of views on methods of technological development. Among other things, the Conference resulted in the establishment of several industrial laboratories. These in turn further stimulated industrial research in Mexico with corresponding end results.

As part of its plan to further the technology of its country, the Banco de Mexico, in the same year as the Mexican-American Conference, expanded its student fellowship program with the creation of 30 new fellowships. Each of these was designated to give a Mexican student an opportunity for advanced study in a selected technical or economic field at a specified foreign university or an industrial operation in a foreign country.

The Armour Research Foundation made available its full facilities to assist in the selection of qualified candidates and to help choose the most suitable institute in each case. Before beginning their formal university studies, a number of students were first sent to the Foundation's laboratories for practical training. The Foundation itself established three research fellowships of two to three years duration, and these were awarded to Mexican graduates for postgraduate work in the United States.

Impetus was given to the progressive technological growth program in Mexico by the construction of a new laboratory building in Mexico City. Built by the Banco de Mexico, the new laboratory from its very beginning allowed a great number of Mexican engineers to work with the Foundation personnel for their mutual benefit. With the completion of this modern, well-equipped laboratory under the technical direction of a senior Foundation staff member, Mexican enterprises are given the same type of practical scientific aid that is enjoyed by industries in the United States.

The Instituto Mexicano de Investigaciones Tecnologicas laboratory, housed in a new reinforced concrete building, covers more than 15,000 square feet of floor space. The structure's facilities include: specialized crushing and grinding equipment, large vats and tanks for experiments on tortilla flour, an

TEXTILES, LIKE OTHER MEXICAN INDUSTRIES, IS BURDENED BY ANTIQUATED METHODS AND EQUIPMENT.

overhead traveling crane for moving heavy machinery and equipment, a steam-heated high-pressure filter, a complete metals and wood-working shop, drafting room, library, and a lunch room. It has its own power system, electric sub-station, and fuel storage facilities. Its development is far from complete since new research problems continually necessitate new equipment and expansion.

Functions

The principal functions of the Institute are:

1. Conduct research programs of broad benefit to the entire Republic, covering industry, natural resources, and agricultural products.

2. Confidential research and development programs for individual private companies—the private company underwrites the cost and receives the exclusive rights to the results of the investigation.

3. Serves as a center of industrial technology in Mexico, stimulating by its action the interest of industries in research and improved practices and the interest of students in pursuing courses in practical technology and engineering.

4. Cooperates fully with the efforts of the Direccion General de Normas toward the development of approved standards and the conduct of appropriate research investigations.

5. Accepts research commitments from all departments of the government to assist them in their work of industrial development.

6. Makes available technical advice and consulting services to aid in the modernization of Mexican factories and industrial operations.

7. Publishes informative technical and semi-technical bulletins and booklets for distribution to industry and the general public. These are either the results on non-confidential research conducted in the institution or simple bulletins on items of modern industrial practices which the reader can adopt for his own use and reference.

Since the establishment of the laboratory, many technical problems facing Mexican industry have been solved. In addition, experimental products have been developed which may substantially aid in raising the standards of living in this country.

Tortilla Flour

One of the best examples of how research has helped even the average citizen in his day-to-day living, is the development of the dry, stable tortilla flour. The present day tortilla has existed through countless centuries. The methods of preparation have been handed down from generation to generation although they are inadequate, time-consuming and unsanitary. The making of tortillas represents a large scale business since approximately 96 percent of the annual production of over 3,000,000 tons of corn in Mexico is used for food, mostly in the form of tortillas, a national dish.

Cognizant of the need for improving the nation's health and economy, the Institute and the Armour Research Foundation embarked on a research program that would determine the possibility of preparing a stable flour for the manufacture of tortillas as well as stoles, and other basic items of Mexican diet. Among the important considerations were the desire for a more sanitary tortilla flour, the need for a stabilized product that would withstand the requirements of modern distribution systems, and, primarily, a food product with improved nutritional value to make up previous deficiencies.

New Methods

The possibility of manufacturing a stable flour that would have a longer shelf life and that would not require elaborate equipment to prepare the tortillas required for each meal lead to an initial study of the existing methods of making tortillas. All the methods used the same basic process of preparing the *masa*—steeping in limewater and grinding. Modern installations sometimes alleviated the problem by the application of small power-driven buhrstone mills, but the actual making of tortillas from the masa has always been a hand operation for the ultimate consumer.

The second step was to determine the most suitable manner in which to market the final product. Possibilities included canning, freezing, and dehydrating. However, experiments indicated that the method of dehydrating appeared to be the most promising approach to the problem.

It had to be determined in the early stages of this project whether the masa produced by regular steeping and grinding methods could be satisfactorily dried. From the results of these experiments, a specially designed drier capable of completely dehydrating the masa with no adverse effect on the flour or on the final tortilla was perfected. Later, a complete pilot plant was built that could produce hundreds of pounds of dry flour per hour.

The completion of the pilot plant marked the end of the experimental stages of this project. It was now possible to produce an acceptable dry tortilla flour that could be sold at a competitive price on the local market.

A program got underway immediately after the completion of the pilot plant to acquaint the Mexican market with the new product. Trucks toured Mexico City and sold both the flour and the prepared dough at ceiling prices established by the government. In this city alone, almost 1,000 tons of tortilla dough are consumed daily. Thus, the project to find a dehydrated flour and make it available to the Mexican people reached a successful conclusion.

For the future, huge dehydrating plants, capable of producing more than 200 tons of stable flour a day, will replace the common hand-grinding bowls. And throughout Mexico, industrial research is helping replace old ideas and methods.

States Sponsor Engineering Surveys

MANY STATES are discovering the value of engineering surveys as a means f promoting industrial development. Engineering consultants are being retained to conduct state-sponsored surveys of industrial potentialities. Results of these studies will permit the states' development agencies to submit concrete proposals to industrial management in an endeavor to attract new industries and foster expansion of existing plants.

Reasons for the trend towards the use of engineering surveys are explained in the remarks recently made by Czar Langston, director of the planning division of Oklahoma's State Planning and Resources Board.

This agency recently awarded the Chemical Plants Division of the Blaw-Knox Company a contract to make a preliminary evaluation of the types of industry the state should try to attract. Terming the projected study one of the most progressive steps taken by Oklahoma for a constructive industrial development program, Langston said it would enable the board to concentrate its efforts to attract new industry.

Oklahoma

"Oklahoma has never had the type of facts available that would give conclusive proof as to advantages of the state's industrial locations," Langston said. "We've been handicapped in the past because of this lack of specific data and are just now getting into a position to do a real selling job."

Blaw-Knox Company's first evaluation will cover all raw materials and other Oklahoma resources required to determine the types of products which could be advantageously manufactured. These specific industries will then be evaluated with regard to location and requirements of possible markets, location and extent of competitive production, location and nature of ultimate consumers, present situation with companies that might be interested, availability of sound commercially-proven processes, and advantages of an Oklahoma location.

The next step planned by the Oklahoma board would be to initiate comprehensive studies on specific products that appear to warrant it. These reports would include descriptions of process and plant facilities with simple flow diagrams and plot plans, an estimate of investment, a manufacturing cost analysis, material balances and utilities, and analyses of raw material sources, markets, and possible plant sites. Reports of this type would enable the planning board to approach industrialists with a concrete proposal.

Vermont

Vermont recently initiated a similar program when its State Development Commission retained the National Farm Chemurgic Council, Inc., to conduct a professional survey of the state's agricultural and industrial potentialities, with emphasis on development of new products and improvement of present products. The report, which is to be submitted not later than next January 30, will include recommendations on how to accomplish development of new products and industries in Vermont, and will list means of upgrading present products grown and manufactured in the state.

Michigan

Ebasco Services Inc. submitted a report early this summer on its study of the economic resources of the Upper Peninsula of Michigan. Costing $20,000 and paid for by business interests of the Lower and Upper Peninsulas, the study was sponsored by the Michigan Economic Development Commission, Lansing, Michigan, after a series of meetings with its Upper Peninsula Advisory Committee.

The Michigan commission stated that the Ebasco report and the resulting flood of favorable publicity for the Peninsula, "hold tremendous promise for that area." Committees of the commission and the Upper Peninsula Development Bureau are preparing a practical program to carry out the report's recommendations. Demand for the report has been so great that the commission decided to publish it in full, with copies being made available at $2.00 each.

A Letter From the Navy

THE COMMENTS printed here were received from Commander J. J. McMullen, USN, after he read the article "Free Piston Engines" in the August issue of CONSULTING ENGINEER. *Commander McMullen is one of the country's experts on free piston design. His foremost objection to our article was his belief that we failed to give the Navy credit for the work done on this type of engine design. In fact, we had suggested that Navy restrictions had retarded rather than advanced American development. This letter represents the first time the Navy has stated its position on this matter for publication.*

Sir:

If I may take the liberty of discussing the article, there are certain comments I should like to make.

The free piston air compressor was perfected a long time ago, and thousands are in daily use in Europe and South America. The design details and advantages should be well known to American manufacturers because the Navy has made Junkers compressors available for evaluation. Shortly after the war, every large air compressor manufacturer in the United States was invited to participate in the free piston air compressor program by the Bureau of Ships. At that time, several of the manufacturers under Navy contracts built "Chinese copies" of the Junkers air compressor. Even after this the air compressor manufacturers declined to pursue the development for commercial purposes. Also the Navy financially sponsored investigation, evaluation, and design of these units to meet Naval requirements. The lack of commercial exploitation by American manufacturers has been due solely to their own desires and may have been largely caused by reluctance to take on a new line which differed widely from their present line of production.

The principal development sponsored by the Navy has been the free piston gas generator—turbine propulsion plant at Baldwin-Lima-Hamilton. When this was initiated, attempts were made to interest several other engineering firms, but all these attempts were completely unsuccessful due to the reluctance of the American manufacturers. Also the project was publicized and everyone had an adequate opportunity to learn about it. Similar work has been going on in Europe for many years, and in the last two years the first units have come into commercial applications. SIGMA in France has been the commercial pioneer. As you know, General Motors has recently completed a complementary agreement with the SIGMA Company for the development and application of their free piston gas generator and free piston air compressor designs here in the United States.

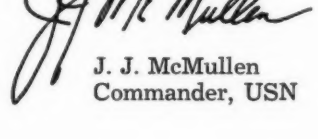
The Navy's development in this field was towards a unit of high specific output; i. e., low weight. All other existing models, including the French, represent the more or less heavy duty approach, and do not have the compactness and lightness required for the ultimate Naval combatant vessels. Nevertheless, the Navy's development did give valuable information for commercial type power plants which the Navy has always been pleased to have the development contractors and manufacturers use. To date, two successful Naval designs have been completed and tested at the Baldwin-Lima-Hamilton Corporation in Hamilton, Ohio. The general design of the first of these was publicly revealed five years ago (reference (d) of your article) and complete operating data was published this year by Mr. Payne and myself (reference (g) of your article). At all times since the Navy commenced development, information has been available on a need-to-know basis. Operating data on the latest successful Navy design is not yet available in sufficient completeness to warrant its release. However, the preliminary operating data have already been made available to many of the country's turbine manufacturers, and the design of the unit is generally known to those in the industry. As a result of the Navy development the B-L-H Corporation also developed a unit for locomotive drive. Most of their efforts have been devoted to the Navy contract, because of financial considerations. Furthermore the latest Navy model has many advanced features, and B-L-H felt the locomotive version could be profitably delayed to permit inclusion of the improved features.

The successful development of the heavy duty commercial design at the Cooper-Bessemer Corporation is directly attributable to the Navy. The initial work accomplished by C-B was on a Junkers free piston air compressor obtained from the Bureau of Ships. In addition, the key personnel directing the C-B development were engaged in the Navy's development at B-L-H for approximately seven years. The knowledge of free pistons which they obtained during that period forms a basis of their present work. The Navy is very pleased that this spreading of free piston knowledge has been accomplished.

I hope you understand that I am very happy that you publicized the free piston development, and my main criticism is that you did not give the Navy the credit which they deserve in this respect. If it had not been for the continued support of the Bureau of Ships, there would be not a single development of free pistons in the United States today. This includes Baldwin-Lima-Hamilton, Cooper-Bessemer, General Motors, and several others who have recently commenced development.

I might mention that Mr. Payne and I have tentative plans to re-present our paper on the Performance of Free-Piston Gas Generators before the Society of Automotive Engineers in Milwaukee on April 3, 1954.

Very truly yours,



J. J. McMullen
Commander, USN

new WIDER VISION

for easier remote boiler water level readings

■ Vastly improved visibility of remote boiler water level readings can now be enjoyed by boiler plant operators.

A new "wide vision" face on Yarway Remote Liquid Level Indicators allows reading from the side as well as front of the indicator. Boiler water levels and other liquid levels can be checked from most any position.

Indicating mechanism is operated by the boiler water level itself—assuring instant, accurate readings.

Yarway Indicators are of the manometric type with automatic temperature compensation, as approved for use under the recent A.S.M.E. Boiler Code Committee ruling in Case #1155.

Over 10,000 are used throughout industry for boiler water and other liquid level indication . . . and for superheater pressure differential indication aboard ship.

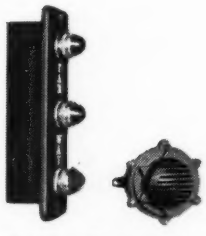
For full information write for Bulletin WG-1823.

YARNALL-WARING COMPANY
106 Mermaid Avenue, Philadelphia 18, Pa.
BRANCH OFFICES IN PRINCIPAL CITIES

A COMPLETE YARWAY SYSTEM

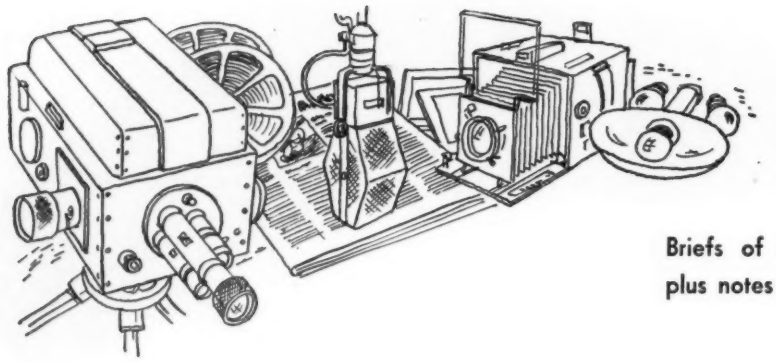
Besides Remote Liquid Level Indicators, Yarway also offers Liquid Level Recorders and Remote Signal Alarms . . . making a complete system for constant, accurate liquid level check.

■ Yarway Hi-Lo-Graph Recorder provides not only water level indication, but also a 24-hour recording of water levels. See Yarway Bulletin WG-1830.



■ Yarway Remote Hi-Lo-Alarm Signals—lights or horns—can be placed at any location in plant. See Yarway Bulletin WG-1823.

YARWAY® | ***remote liquid level indicators***



NEWS

Briefs of current interest to the consulting profession plus notes on new equipment in the field of engineering

Expressway Access Ramps Feature Snow Melting System

While most of the nation's modern roads are built for speed and safety, designers of the Boston Aerial Highway are going a step further by installing heating pipes to melt snow and ice from all access ramps of the new thoroughfare. When completed, the expressway will include the largest snow melting installation in the country. The total area served amounts to more than 161,000 sq ft of pavement.

More than 200 tons of small-size (one and two inch) A. M. Byers Co. wrought iron pipe was selected because of its ability to resist corrosion and vibration damage. The pipe, welded into 10 by 22 ft grids, is arranged in series and buried in the concrete.

To operate the systems, steam supplied by Boston Edison Co., is fed to heat exchangers. Water mixed with Ethylene-Glycol anti-freeze, is circulated through heat exchangers and pipe net-works.

The designers, architects-engineers Fay, Spofford & Thorndyke and the Commonwealth of Massachusetts Bridge Dept., expect the system to help keep traffic flowing even during the most severe snow storms. ▲▲

Production Equipment Is Twenty-Eight Percent Obsolete

American industry admits that 28% of its present production equipment and manufacturing processes are already obsolete or inadequate, according to an industry-wide survey by the American Society of Tool Engineers. Findings of the survey reveal that:

30% of machining equipment now being used is considered obsolete by industry itself.

34% of present inspection methods are obsolete.

28% of the materials handling equipment and processes are inadequate or completely obsolete.

28% of metal-forming processes are in need of modernization or replacement.

25% of industry's production welding equipment is admittedly outdated.

23% of present grinding and finishing equipment is either obsolete or worn out.

Survey tabulations were broken down into four plant size groupings: (1) the small plants, those having less than 250 employees; (2) the intermediate size plants with 250 to 999 employees; (3) large plants having 1000 to 4999 employees and (4) the very largest companies—those having over 5000 employees. The figures above are averages for the four plant classifications. ▲▲

Direct-Color Printing Method Is Rapid and Low Cost

Because color has an amazing power to affect people's desires and actions, its importance has long been recognized as a prime mover in sales work. With the advent of Chromastat, a low cost rapid method of reproduction, it is now the policy of Quinton Engineers, Ltd., Los Angeles consulting

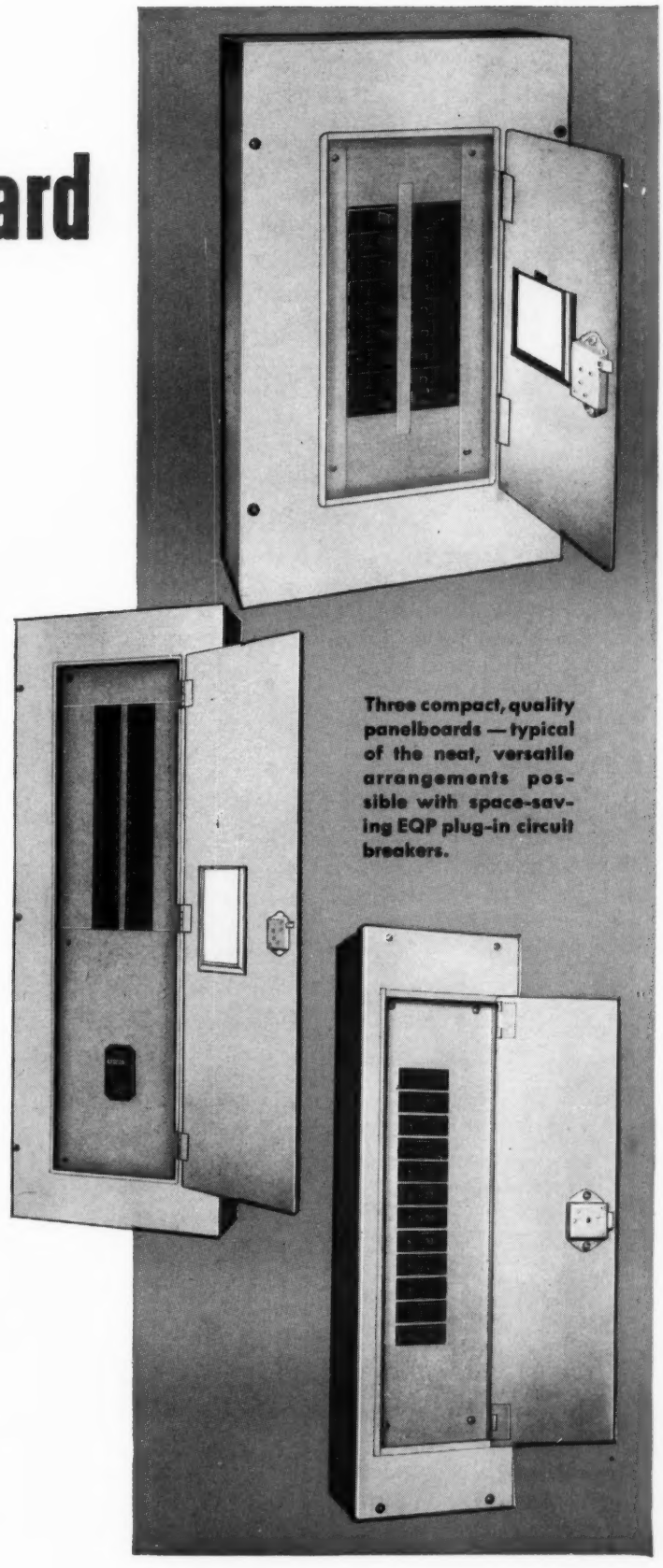
in your panelboard

Your local independent panelboard builder

can supply you with:

1. The exact type panelboards you need for every industrial and commercial application.
2. panelboards housing top-quality I-T-E Molded Case Circuit Breakers.

I-T-E Molded Case Circuit Breakers are built for incorporation in the designs of the country's leading independent panelboard builders. And there's a complete line to choose from. So be sure to order your panelboards "with I-T-E circuit breakers"—and know you have the best.



Three compact, quality panelboards — typical of the neat, versatile arrangements possible with space-saving EQP plug-in circuit breakers.

REMEMBER—

You don't have to compromise with quality to utilize the new, compact panelboards now available. Specify I-T-E circuit breakers and I-T-E panelboard construction—throughout. Your local panelboard builder will gladly give you details.

I-T-E CIRCUIT BREAKER COMPANY
19th and Hamilton Sts.
Philadelphia 30, Pa.

MOLDED CASE CIRCUIT BREAKERS

Printing Method Is Low Cost

—*Starts on page 52*

engineering firm, to make virtually unrestricted use of direct color reproductions from illustrations of their projects.

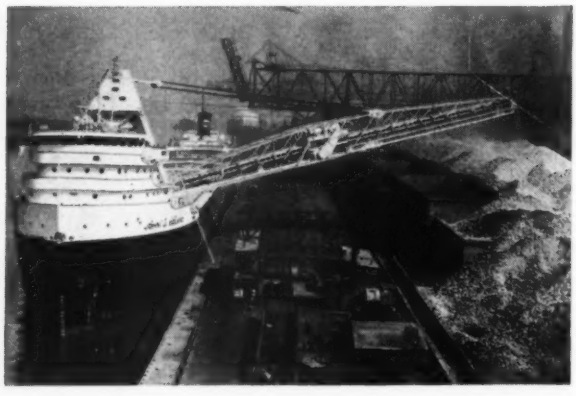
Costing 50 to 80 percent less than existing processes, dependent on print size, the prints have been found to be a sound and economical means of presentation.

An example of the importance and selling power of the visual color presentation, was its successful use in selling the public on a California city school bond issue. Large color prints of the proposed structures were placed in strategic locations in business houses, to better acquaint the public with the advantages of the project in terms of improved educational facilities.

Illustrator Gene Shrewsbury of Pasadena, California, a pioneer in the development of the architectural illustration technique, and the Rapid Colorprint Service, Glendale, Calif., developed the direct color printing method, which is now being used throughout the country. ▲▲

Consulting Engineers to Hear Major General Draper

Speaker at the December 2, luncheon meeting of the American Institute of Consulting Engineers will be Major General William Draper; his subject, "Where Are We Going in Europe?" The meeting will be at the City Midday Club, 23 S. William St., New York City. ▲▲

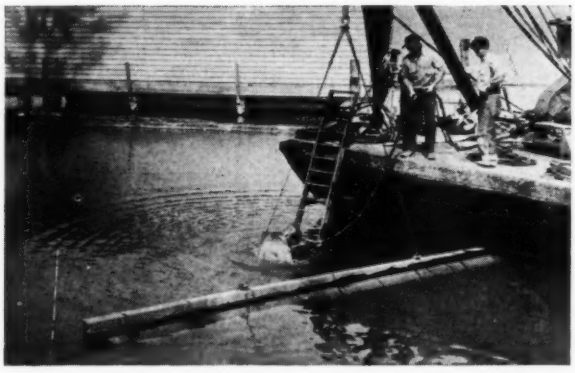


New Boat Equipped with Self-Unloading Machinery

A giant new lake boat, the S. S. John J. Boland, has been equipped with self-unloading machinery capable of discharging an 18,000-ton cargo of limestone in four hours or less.

The self-unloading equipment, designed by Hewitt-Robins, Inc., can transfer cargo from ship to shore at least one-third faster than older unloaders. A conveyor and elevator system in the hold brings the cargo to deck level. There it is automatically transferred to another conveyor mounted on a 250-ft boom which swings out from the side of the boat and deposits the material in neat piles on the shore without the aid of land-based equipment of any kind. When the unloading is completed, the boom conveyor is swung back to the deck and the boat lifts anchor for another trip.

The boat is owned by the American Steamship Co. of Buffalo, which owns 17 other vessels on the Great Lakes for the transportation of coal, coke, gypsum, and limestone. ▲▲



Steel Strapping Reduces Time for Underwater Sewer Installation

By fastening four concrete sewer pipes to 6 x 8 in. timbers with steel strapping, the McCray Marine Construction Co. reduced diver and crew time and speeded underwater installation of a sewer outlet at Lake Washington in the state of Washington.

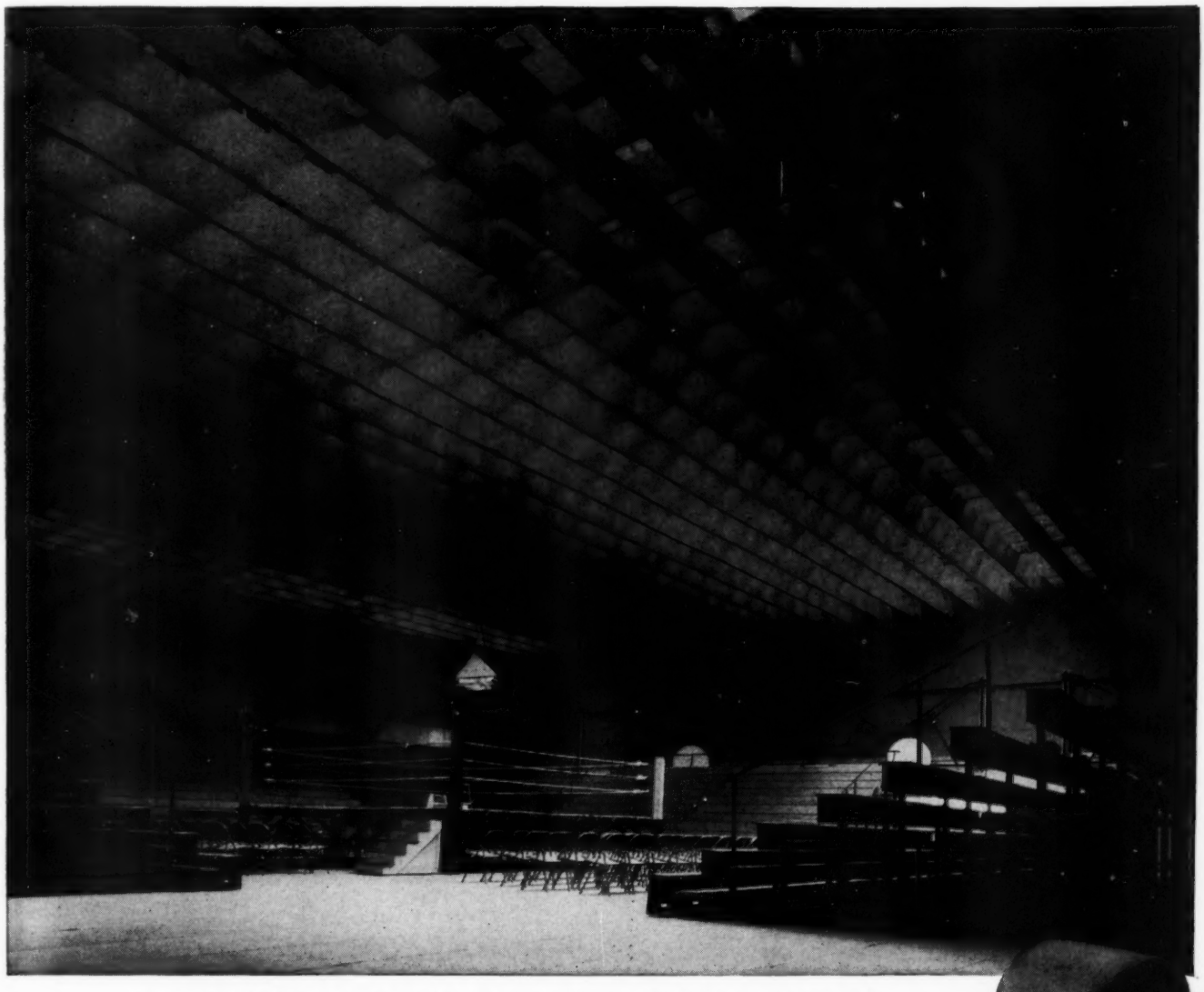
Rather than lay one four-ft length of pipe at a time, the crew strapped five lengths to 20-ft timbers, placed them on a barge and hauled them to the installation site. There, each section was lowered by a winch, guided into place by the diver and joined to previously positioned sections. Some sections were placed as much as 40 ft below the water's surface. ▲▲

First Issue of Optical Industry Directory Is Being Compiled

The Optical Publishing Co. of Huntington, L. I., N. Y., is currently engaged in the final operation of verifying its accumulated information for The Optical Industry Directory.

This phase of compilation involves circulation of some 2500 questionnaires to the manufacturers, suppliers, and designers of the instruments, materials, and components used by the industry. The questionnaire lists some two hundred optical items and requests source-of-supply information that will be incorporated in the directory. More complete listings of consultants and designers capable of handling optical problems are being sought.

Five thousand copies will be printed and these



Foster High School, Seattle, Washington, awarded First Prize by the American Association of School Administrators. Architect: Ralph H. Burkhard

How sound was baffled by ULTRALITE in this architectural award-winning school

One of the most unusual of the many novel design features in this prize-winning school was the acoustical application of Ultralite glass fiber insulation baffles in the gymnasium. These baffles consist of two levels of criss-crossing panels of Ultralite suspended on wires by metal clips. This unusual application has proved most effective in controlling sound; reverberation and echo are virtually non-existent.

Ultralite thermal insulation was also used as a basic building material in the Foster High School. To provide the required thermal protection, Ultralite with vapor barrier facings was installed on the underside of the roof in the gymnasium, classrooms and corridors.

Light in weight, flexible, resilient, with a unique "long-staple" strength, Ultralite glass fiber insulation lends itself to many thermal and acoustical applications not possible with other insulations. For details, see section 6a of Sweet's Architectural File, call your local Ultralite distributor, or write for latest literature.

gb

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212 W. 10th St., Kansas City, Mo.

New York • Chicago • Philadelphia • San Francisco • Los Angeles • Houston • Tulsa
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Directory Is Being Compiled

—*Starts on page 56*

will be distributed to the listed companies, to the technical libraries of the country, and to the military procurement offices. The remaining issues will be available for miscellaneous circulation. ▲▲

Changes in Design Engineering Expected With Use of New Alloy

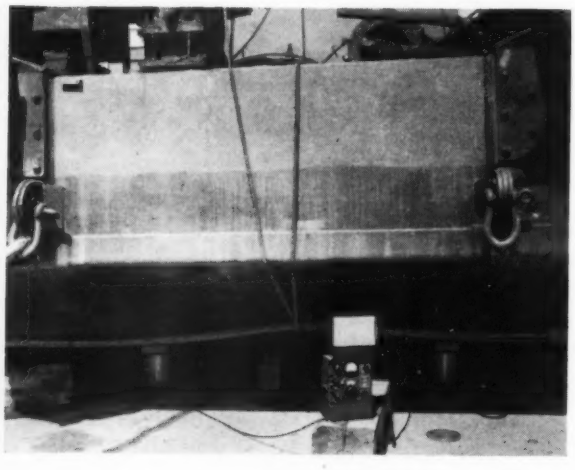
Expected to play an important role in the field of materials engineering and to serve many applications not covered adequately by other metals and alloys now in use, the beryllium-copper alloy, Beryldur is seen as a potential rival of bronzes and brasses.

A product of the Beryllium Corp., it is described as filling the gap of property ranges existing between the two basic groups of beryllium-copper alloys: the high strength and the high conductivity groups. It is said to combine high strength and hardness values with extraordinary toughness and good electrical conductivity.

Properties may be varied at will by a simple heat treatment that is nearly fool-proof, according to the company, and is capable of working and moderate shaping after mill-hardening.

To simplify application, it is produced in only two tempers: heat-treatable and mill-hardened. The former is desirable where severe forming is needed or where peak physical properties of the alloy are essential. Mill-hardened Beryldur requires no heat treatment of finished parts.

Important applications are predicted for the electro-mechanical field, especially in the manufacture of springs and switches. ▲▲



Load Cells Used To Determine Weight Electrically

Under a 181 ton dredge are four Baldwin-Lima-Hamilton Corp. SR-4 Load Cells (one at each corner) used to weigh the dredge before launching. The weight on each cell was read on a portable load indicator.

These 200,000-lb capacity load cells are only 11 in. high, 7 in. in diameter, and weigh 40 lb. Weighing accuracy is within 0.25 percent of full range.

Weight sensing elements in the cells are resistance wire strain gages, bonded to a high strength steel column sealed inside the load cell. A strain gage is a postage-stamp-size, insulated grid of wire finer than human hair. It is cemented to the surface of a part that is to be subjected to stress so that strains, either in tension or compression, stretch or shorten the wire in the grid. This changes its electrical resistance which can be measured by suitable instruments and may be translated into pounds or other units of weight.

Weight of the dredge was required as a basis for rigging charges before it could be launched at a Bridgeport, N.J., shipyard by the Weldon Contracting Company. ▲▲

System of Roof and Floor Construction Is Time Saving

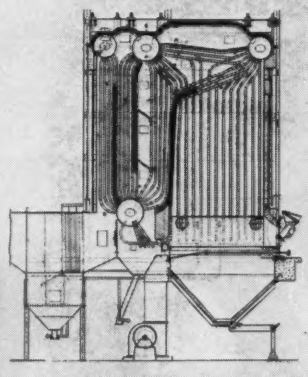
Shoring, forming, and placing of reinforcing steel as used in solid slab construction is eliminated by the use of Rapidex, a new system of construction for roofs and floors.

The individual blocks that are the component parts of each Rapidex unit slab section are made of coarse and fine Haydite aggregate and Portland cement. The Haydite concrete in these units has a compression strength of 3000 lbs per sq in. after 28 days. The design of the blocks used in the fabrication provides a "tongue and groove" joint between the unit slabs, and when the joints are properly grouted, the entire deck area becomes an integral slab of concrete.

Use of Haydite also gives it light weight in proportion to its high strength—8 in. Rapidex weighs 42 lbs per sq ft—light wave dispersion, resistance to deterioration, excellent accoustical properties, high resistance to fire, and provides an excellent bond for cement toppings. The core holes offer additional economy, as they are used for heat ducts, cold air returns, and for concealing piping and conduit. Allowances for dead load deflection can be made by actually "pre-arching" the slabs.

It is manufactured in lengths up to 29 ft by the

Add the Advantages...



1. VERTICAL DESIGN

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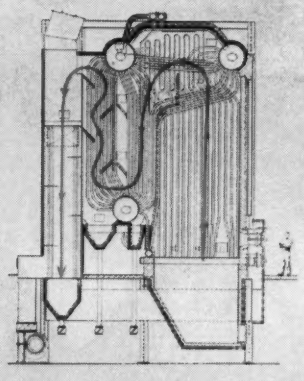
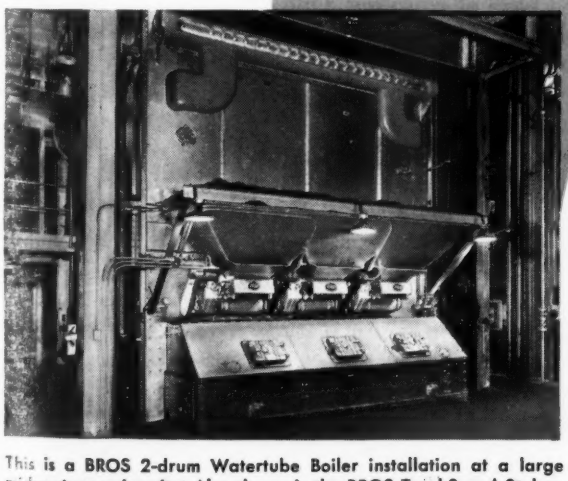


2. LONG GAS TRAVEL

=

BROS vertical water tube and baffle arrangement means less clinging of soot or fly ash. A cleaner boiler means more rapid heat transfer! BROS elongated gas travel means that all possible energy is wrung from the gas and converted to steam. Together, these advantages mean sustained high efficiency over long operating periods.

You'll Choose BROS



This is a BROS 2-drum Watertube Boiler installation at a large midwestern university. Also shown is the BROS Travl-Spred Stoker. These units are dependable parts of a plant which produces heat for campus buildings.

Before you specify your next steam generating unit, talk to a man from BROS. He can tell you concisely what a BROS-designed watertube boiler offers you. Two of the points are illustrated above. Since 1888 BROS engineers have specialized in these features which make boilers deliver the most steam for the least money in a specified application. Many of these BROS advantages are exclusive. Find out how they can serve you!

Watch for other BROS advantages to be described in forthcoming ads in this series. ADD THE ADVANTAGES . . . YOU'LL CHOOSE BROS!

BROS

Power Division: **WM. BROS BOILER & MFG. COMPANY**
1057 Tenth Ave. S. E., Minneapolis 14, Minnesota

DESIGNERS AND MANUFACTURERS OF 2, 3 AND 4 DRUM WATERTUBE BOILERS, SUPERHEATERS, AIR HEATERS, ECONOMIZERS, ACCESSORIES, AUXILIARIES, PLUS A FULL LINE OF HEAVY-DUTY STOKERS

Construction System Is Time Saving

—*Starts on page 58*

Spickelmier Co., Indianapolis, Ind., and is delivered ready for immediate use. Rapidex is set in place as it is unloaded from the truck which eliminates intermediate handling. ▲▲

Educational Program Offered in Scientific Equipment Analysis

Professional consulting services on company equipment analysis programs will be available to individual companies in the near future. The Council for Technological Advancement is currently working with Cresap, McCormick and Paget, management engineering firm, in preparation for an equipment analysis department.

Education and research in the field of scientific equipment analysis will be greatly advanced through the newly-founded National Center of Education and Research in Dynamic Equipment Policy at Illinois Institute of Technology in Chicago. The Center is jointly sponsored by Illinois Institute, the Council, and the Machinery Institute.

Summer seminars and conferences for concentrated study of equipment analysis and replacement methods will be presented for executives occupied in or preparing for these positions. ▲▲

Plastic Pipe Used to Replace Rubber-Lined Steel Pipe

The City of Los Angeles is achieving cost-savings of approximately 50 percent on the pipe itself, and additional savings on installation, by replacing rubber-lined steel pipe with glass-fiber reinforced plastic pipe on the $71 million Los Angeles Department of Water and Power Valley Steam Generating Plant under construction in Los Angeles. The pipe will convey acid waters in the boiler feed, water treatment, and waste disposal systems. A pending installation of significance to municipalities in the same project is the transmission of fresh water by plastic pipe instead of by the currently-used cast iron pipe. Plastic pipe's smooth, seamless interior wall surfaces are said to discourage attachment of mineral and biological deposits found in pipe lines.

The pipe used, Reflin, has overcome many of the limitations of presently used plastic pipe materials which previously have limited the widespread acceptance of plastic pipe, according to the manufacturer, the Reflin Co., Gardena, Calif. It is available in larger diameter (from 4 to 10 in.), is stronger, tougher, lighter, and has greater temperature range of operation (from −90 to 230 F). It is nearly chemically inert and has no tendency to cold-flow. While steel pipe fails through corrosion in from three to four years, and gray iron with good corrosion resistance will last ten years, Reflin pipe will resist corrosion indefinitely. ▲▲

Aluminum Construction Pipe Used on Turnpike Project

By using lightweight aluminum pipe for compressed air lines, two prime contractors have been able to save time and labor in difficult blasting and grading operations on the $100 million West Virginia Turnpike.

The advantage of the lightweight Alcoa aluminum construction pipe can be found in its portability and ease of coupling. One or two workmen can rapidly lay a compressed air line with the 20 ft sections of pipe which weigh only 15 lbs each.

Groves, Lundin and Cox pump air into four-in. aluminum line using either three or four 600 cfm diesel powered air compressors. These compressors operating together maintain a line pressure up to 130 psi in the aluminum line. The line is then tapped to run as many as six wagon drills at one time.

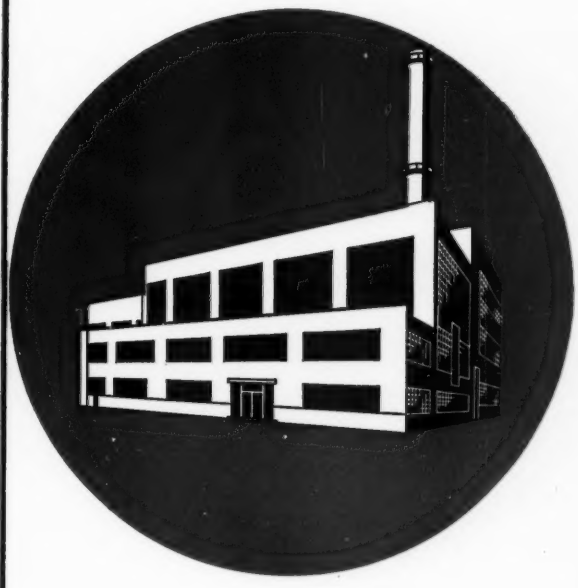
The compressors are coupled with a threaded connection to a steel pipe section. The aluminum pipe line is in turn coupled to this steel section. The pipe is joined together with a new type coupling made by R. M. Wade and Co. which can be connected or disconnected in a matter of seconds by inserting or pulling a single pin.

S. J. Groves and Son uses a sleeve-type coupling made by Morris Couplings and Clamp Co. This coupler is secured rapidly by tightening two or three bolts. ▲▲

City of Manitowoc installs fifth WICKES steam generator

To provide a dependable source of power for the City of Manitowoc, Wisconsin, the Manitowoc Public Utilities Commission has just installed a fifth WICKES Steam Generator capable of producing 175,000 lbs. of steam per hour at 525 psi. Final steam temperature is 750°F. The new WICKES Boiler has 11,600 sq. ft. of heating surface. It is equipped with an economizer and fired by spreader stoker.

R. E. Cannard — Chief Engineer and General Manager



WICKES can fill your requirements for all types of multiple drum boilers generating up to 250,000 lbs. steam per hour at pressures up to 1000 psi. adaptable to any standard method of firing — oil, gas, single retort underfeed or spreader stoker. For pressures up to 900 psi. with sustained steam production up to 35,000 lbs. WICKES Type A Boilers can be shop assembled, ready for immediate installation. Write today for descriptive literature or consult your nearest WICKES representative.

Wickes

THE WICKES BOILER CO., SAGINAW, MICHIGAN RECOGNIZED QUALITY SINCE 1854
DIVISION OF THE WICKES CORPORATION

SALES OFFICES: Albuquerque, N. M. • Atlanta • Boston • Charlotte, N. C. • Chicago • Cincinnati • Cleveland • Dallas • Denver • Detroit • Fort Wayne, Ind. • Greensboro, N. C. • Houston • Indianapolis • Los Angeles • Memphis • Milwaukee • New York City • Orangeburgh, S. C. • Pittsburgh • Portland, Ore. • Saginaw • Salt Lake City • San Francisco • Springfield, Ill. • Tampa, Fla. • Tulsa • Washington, D. C.

150

MEN IN ENGINEERING

★ Max Jaenchen has accepted the appointment as chief consulting engineer of the Mannesmann-Meer Engineering & Construction Co. He will also supervise installations of Mannesmann-Meer mill machinery, including the first mechanical extrusion presses ever made in this country to produce seamless steel tubing.

★ G. B. Gusrae, formerly with Voorhees, Walker, Foley & Smith and author of many articles on vertical transportation (CE, March, September, '53), has opened an office at 6 East 39th St., New York City. He will specialize as engineering consultant to architects and engineers on all forms of vertical transportation.

★ Francis L. Brown, partner, Brown & Blauvelt, announces that the Government of Indonesia has entered into a contract with their firm and the Utah Construction Co. of San Francisco for a joint venture by the two concerns. The joint venture has sent a survey team to Indonesia to prepare a report on the necessary operations required to increase production of rice on the Island of Sumatra.

★ The 1954 officers elected by the Association of Iron and Steel Engineers are president, E. L. Anderson, Bethlehem Steel Co.; first vice president, J. H. Vohr, U. S. Steel Corp; second vice president, W. H. Collison, Great Lakes Steel Corp; treasurer, J. D. O'Roark, Weirton Steel Co; and secretary, L. Larson, Republic Steel Corp.

★ The resignation of Marion W. Boyer as general manager for the Atomic Energy Commission and the appointment of Maj. Gen. K. D. Nichols, wartime district engineer for the Manhattan District, as his successor were announced. The change was effective Nov. 1.

★ United Engineering Trustees, Inc. elected officers for the ensuing year, naming J. L. Head of Anaconda Copper Mining Co. as president. Other officers elected were G. F. Moulton of Rockefeller Brothers, Inc. and Walter J. Barrett of New Jersey Bell Telephone Co., vice presidents; W. G. Bowman of McGraw-Hill Publishing Co., treasurer; J. L. Kopf of Jabez Burns & Sons, Inc., assistant treasurer; J. H. R. Arms was re-elected as secretary and general manager.

★ R. P. Allison is appointed manufacturing consultant to the General Electric Company's Weathertron Dept. The appointment is in line with the company's expansion of activity in the heat pump field.

★ Cleo Nike Stathes joins Sundberg-Ferar, Inc. as the second feminine member of its staff of industrial designers. The firm which was formerly operated as a partnership by Carl W. Sundberg and Montgomery Ferar is now incorporated and known as Sundberg-Ferar, Inc.

ENGINEERS TOUR WATER EXHIBIT

L. C. Venator, general manager, Museum of Science and Industry of California, points out features of new $80,000 water resources exhibit to engineering executives of Francis H. Bulot, Inc., consulting engineers. Left to right are: J. T. Robinson, K. Brunner, Francis H. Bulot, C. W. Messing, and R. G. Bulot

★ Wm. H. Byrne, president of Byrne Associates, Inc. and Stevens & Wood Inc., is shown being sworn in as Honorary Deputy Commissioner

SHIRLEY BYRNE

of the New York City Dept. of Commerce by Commissioner of Commerce, Walter T. Shirley. In announcing the appointment, Commissioner Shirley said, "It is gratifying to know that our Department will be able to enjoy the advice and counsel of such an outstanding engineer as Mr. Byrne in the solution of the many problems confronting our commercial and industrial community."

★ A. M. Rawn, chief engineer and general manager, Los Angeles County Sanitation Districts, is elected chairman of the State Water Pollution Control Board to succeed General Warren T. Hannum, retired State Director of Natural Resources.

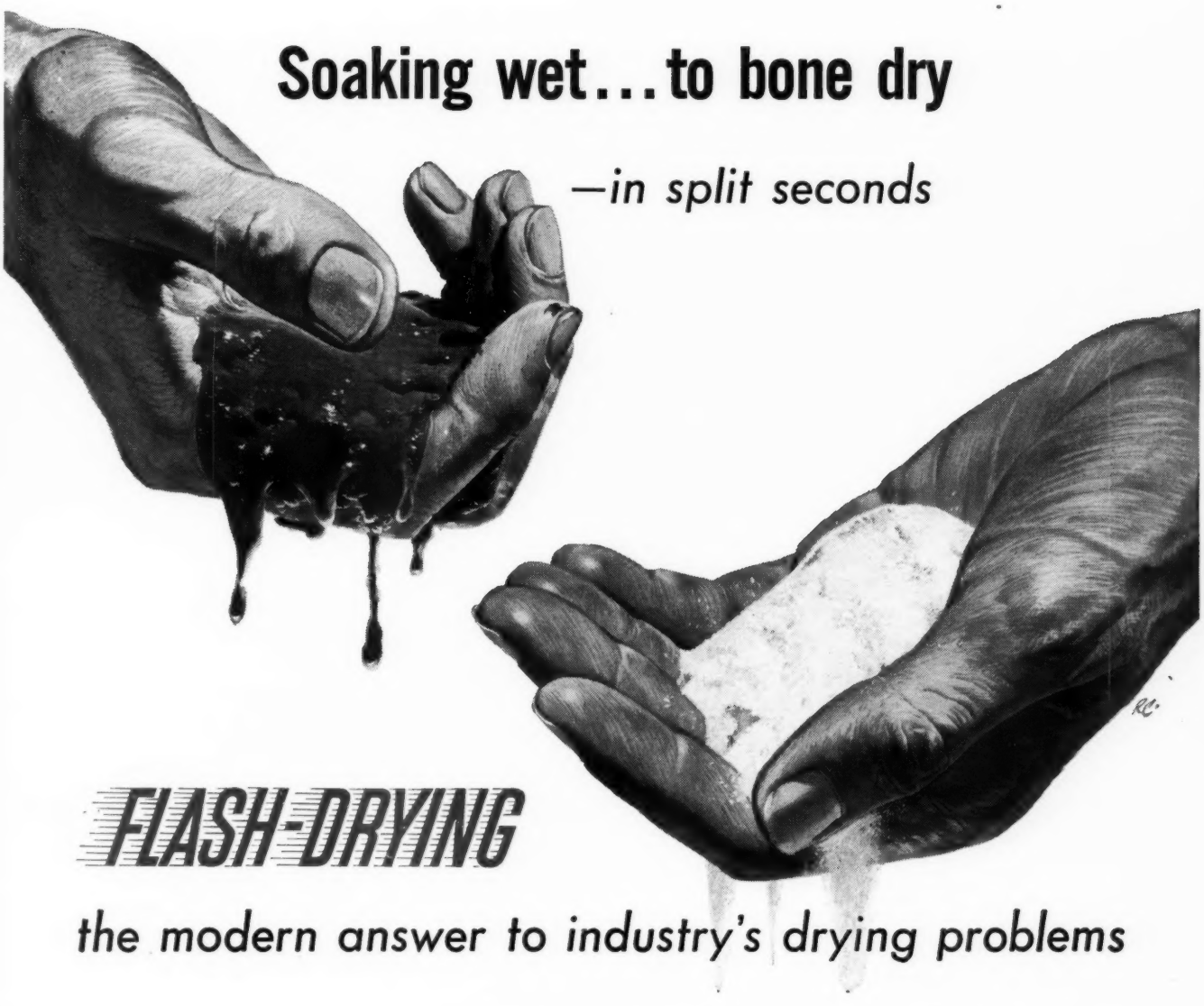
★ Election of Virgil M. Graham as a vice president and member of the Executive Committee of the U. S. National Committee of the International Electrotechnical Commission (IEC) is announced by the American Standards Association, the American parent body.

★ E. W. Spannhake, formerly associated with Barnes and Reinecke, Inc. is named director of engineering and research for LeTourneau-Westinghouse Company. He will be responsible for coordinating engineering functions involving product research, design and development. R. G. LeTourneau will continue to serve the company on a part time basis as an engineering consultant.

★ Appointments in the Engineering and Construction Division of Koppers Company, Inc. are announced. George P. Wilson, Jr., is named manager of the finance dept. and Herbert A. Semler assumes broader responsibilities as manager of the control section for the entire

Soaking wet...to bone dry

—in split seconds



FLASH-DRYING

the modern answer to industry's drying problems

Moist fines dried in a twinkling to bone-dry powder—that is the magic of Flash Drying.

In this ingenious Combustion-pioneered process, air ... so hot it would melt aluminum ... almost explodes moisture from wet materials, yet a touch so gentle and swift that scorching and burning never occur.

And—at the same time—these wet particles can be pulverized and classified to any desired fineness.

Wet coal fines from mine washeries are dried to a valuable fuel ... synthetic resins are dried and pulverized to desired fineness ... various types of clays are dried, pulverized and classified, as are bauxite, limestone, talc and many other industrial minerals. Sewage sludge is dried and then incinerated to a sterile ash or converted to a saleable fertilizer. Industrial sludges and many other wet wastes are *dried in a flash* by the C-E Raymond System.

Flash Drying is but one of Combustion's many activities. Steam generating and fuel burning equipment ... chemical recovery systems ... pressure vessels ... even automatic water heaters for your home are some of the diverse fields that help make the C-E Trade Mark a symbol of efficiency and reliability the world over.

So bring your problems of materials drying, pulverizing and classification ... or those you may have in any other fields of C-E activity ... to Combustion. Backed by more than 65 years of specialized knowledge and experience, chances are C-E can help you to a sound, economical solution.

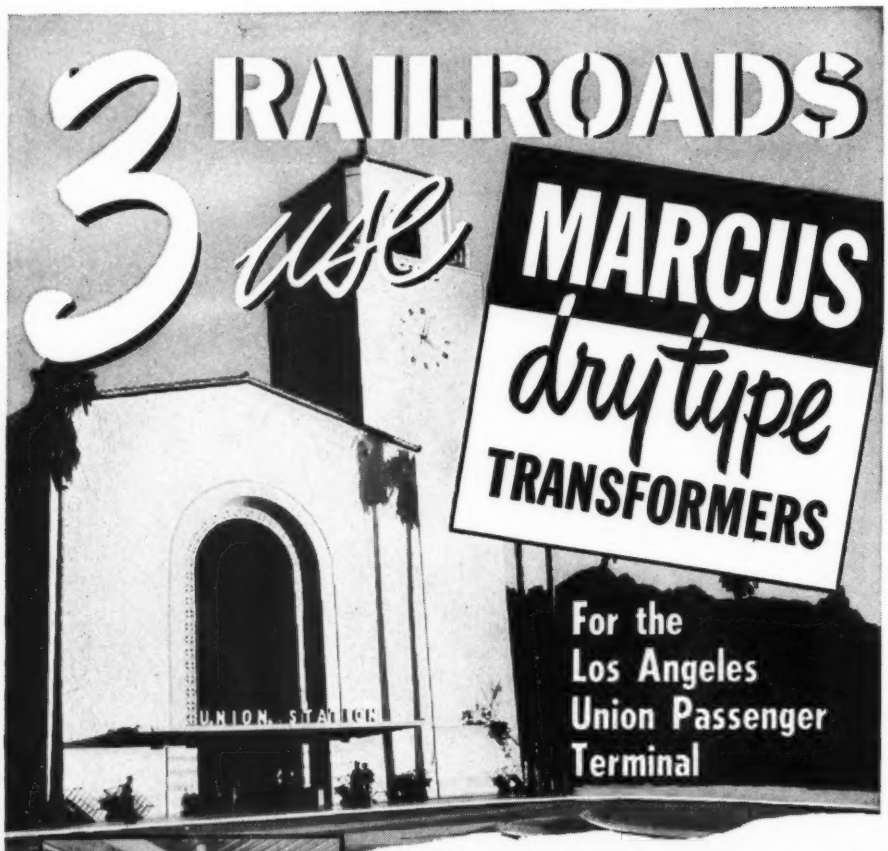
ALL TYPES OF STEAM GENERATING, FUEL BURNING AND RELATED EQUIPMENT

B-650

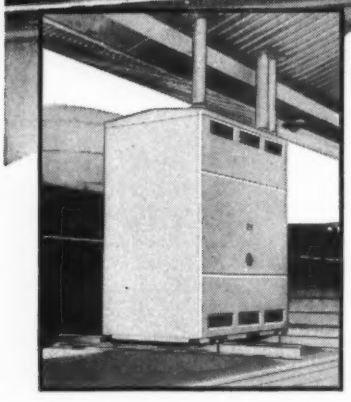
COMBUSTION ENGINEERING, INC.

Combustion Engineering Building • 200 Madison Avenue, New York 16, N. Y.

3 RAILROADS use MARCUS dry type TRANSFORMERS



For the Los Angeles Union Passenger Terminal



SANTA FE RAILWAY | UNION PACIFIC RAILROAD | SOUTHERN PACIFIC COMPANY

Specifications for the stringent power requirements for Los Angeles Union Passenger Terminal were set up by a group of electrical engineers representing the three railroads that operate the terminal, and were met by the purchase of Marcus dry type Transformers.

The installation consisted of 12 Marcus 300 KVA, 3 Marcus 225 KVA dry type Transformers installed outdoors. All Marcus dry type Transformers are now being constructed with Hi-Heat, Hi-Dielectric Magnet Wire, insulated with DuPont's Newest miracle polyester film "Mylar," combined with Johns-Manville "Quinterra" to reach insulation levels at least 10 times present industry standards.

Increase your power performance standards with Marcus dry type Transformers.

Capacities from 1 to 3000 KVA

- DISTRIBUTION
- GENERAL PURPOSE
- UNIT SUBSTATION
- PHASE CHANGING
- ELECTRIC FURNACE
- RECTIFIER
- WELDING
- MOTOR STARTING
- SPECIAL

MTG

"Mark of Quality"

Representatives in Principal Cities

MARCUS TRANSFORMER CO., INC.
HILLSIDE 5, NEW JERSEY

ONE OF THE WORLD'S LARGEST MANUFACTURERS OF DRY TYPE TRANSFORMERS EXCLUSIVELY

MEN

—*Starts on page 62*

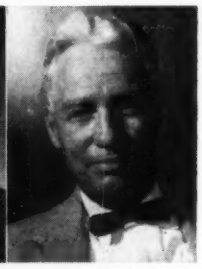
division. New sales manager of the Freyn Dept. is Arthur J. Whitcomb.

★ Turbine Equipment Company announces the formation of its Hynes Electric Heating Division. Lee P. Hynes will be retained as electrical and mechanical consulting engineer.

★ Dr. William D. Coolidge, director emeritus of the G-E Research Laboratory, was honored recently on his 80th birthday with a reception and dinner at Nela Park in the G-E Lighting Institute.

★ Charles S. Lumley is named vice president and general manager of Burns & Roe of Michigan, Inc., newly created Detroit branch of Burns & Roe, Inc., New York. The new offices will provide a complete architectural and engineering service for the company's clients in the Great Lakes region.

LUMLEY



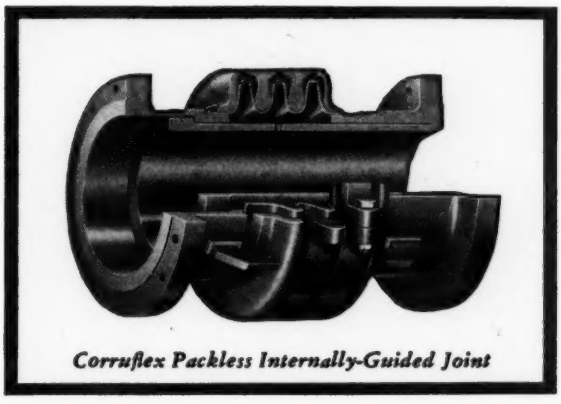
WILLIAMS

★ T. Cortlandt Williams of Boston is elected executive vice president of Stone & Webster Engineering Corp. He will continue his present responsibilities as senior construction manager, and will be responsible also for executive direction and coordination of company activities at Boston.

★ Appointment of D. H. Silvern, former head of the Analysis Section, Gas Turbine Dept at Clark Brothers Co., as senior engineer in charge of the Gas Turbine Analysis Group at Continental Aviation & Engineering Corp. is announced.

★ Scientific Design Co., Inc., announces the appointment of David Brown as director of process development. Prior to this appointment, he served with Shell Development Co. as senior development engineer in the Process Engineering Dept.

★ O. B. Falls, Jr. is named manager, electric utility sales of the Apparatus Sales Div., General Electric Co. Appointment of J. Stuart Franklin as supervisor of G-E's Lighting and Rectifier Dept Photometric Laboratory is announced. Establishment of a Specialty Con-

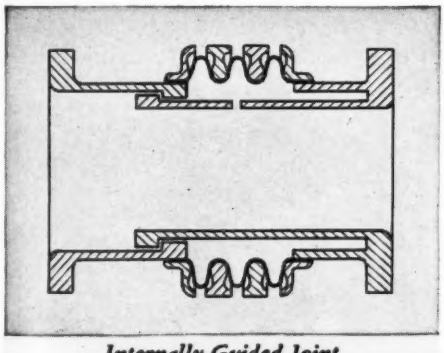


Corruflex Packless Internally-Guided Joint

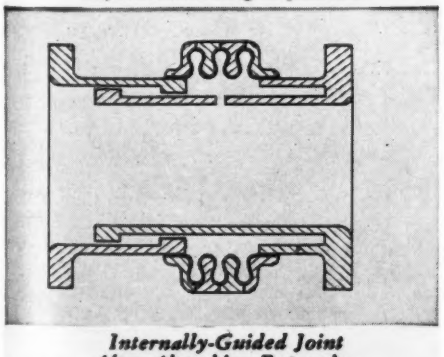
MASTERPIECE OF ADSCO ENGINEERING

Corruflex INTERNALLY-GUIDED EXPANSION JOINT

PROVIDES RIGIDITY IN SPECIAL PIPING PROBLEMS



Internally-Guided Joint Before Absorbing Expansion



Internally-Guided Joint After Absorbing Expansion

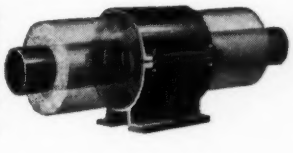
One of many reasons why Corruflex Packless Expansion Joints are so widely used by progressive engineers is the completeness of the Corruflex line. There is a Corruflex joint to absorb pipe expansion under *any* piping condition.

Suppose an engineer wants a joint which provides rigid construction against all movement except axial movement. ADSCO has the perfect solution — the Corruflex Internally-Guided Expansion Joint. No maintenance required because it is packless. Joint is built with an internal sleeve of heavy wall construction for effective guiding. Inner end of sleeve has a guide ring riding on a machined bore to insure true axial movement. Limit stop prevents the joint from being extended beyond its predetermined limit.

ADSCO makes the most complete line of expansion joints of any manufacturer in the world. That means complete engineering! Come to ADSCO for the *right* joint.

Don't let pipes get out of line

Use ADSCO Alignment Guides with ADSCO Expansion Joints. Cylinder is 12" long in all sizes, permitting pipe movement of 10". Damage to insulation prevented by ample clearance between guiding cylinder and pipe.



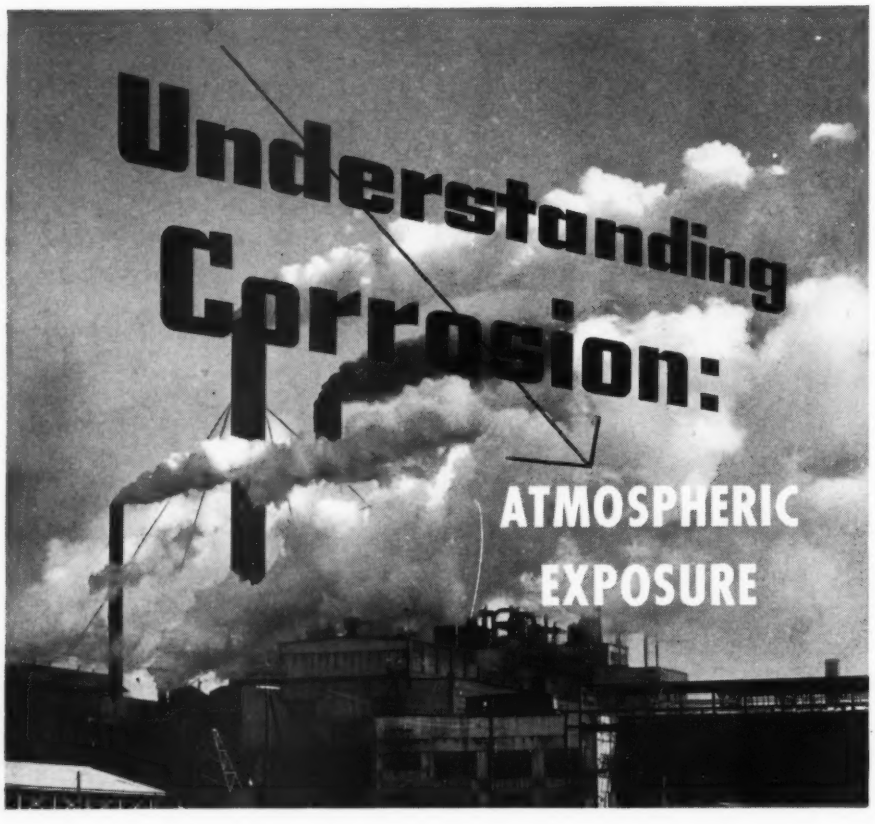
ADSCO ENGINEERED PRODUCTS

EXPANSION JOINTS • HEAT EXCHANGERS • STEAM TRAPS • STRAINERS • SEPARATORS • METERS

AMERICAN DISTRICT STEAM COMPANY, INC.

NORTH TONAWANDA, NEW YORK

Since 1877



The extent to which metal will corrode in atmosphere — or even whether it will corrode at all to any appreciable degree — is determined primarily by the moisture content of air. While deterioration at normal temperatures and humidities of less than 35% is so slow as to be almost negligible, the rate accelerates rapidly beyond a critical point of approximately 65%. This activity is intensified when such contaminants as hydrogen sulfide or sulfur dioxide are absorbed from industrial atmospheres. Impingement of solids, which tends to hold this acid film in contact with metal, localizes and further advances corrosive attack.

When exposure to atmosphere includes also exposure to sunlight and to the variables of weather, the situation becomes more complex. Such factors as the composition of metal and of the protective rust film that forms upon it, the length of time surfaces are wet, the extent to which they retain moisture, and whether they may be bared intermittently by heavy rainfall are influential in determining metal life.

An understanding of the mechanism of corrosion in all of its varied phases is an obvious requisite to prescribing methods of control. Thirty-five years' study and evaluation of industrial corrosion problems and the formulation of protective coatings to meet them has taught us something about corrosion and the ways in which it may be checked successfully.

We are ready to share that knowledge with you in an analysis of any metal-maintenance problem you feel requires the *different* approach of considered engineering judgment . . . to give you a recommendation you can be sure is technically correct and practically workable — for quality protective surfacing that is right for you because it is individually job-selected to meet your service specifications.

MAINTENANCE FOR METAL

THE DAMPNEY COMPANY

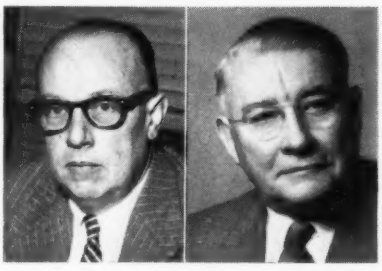
160-1 HYDE PARK, BOSTON 36, MASSACHUSETTS

MEN

—Starts on page 62

trol Dept at G-E's Schenectady Works and the appointment of Dr. Louis T. Rader as its general manager is announced. Concurrently, Dr. Rader named the following to his staff: K. N. Bush, manager of manufacturing; H. L. Palmer, manager of engineering; J. P. Rutherford, manager of marketing; and C. S. Van Wormer, manager of finance.

★ Don E. Grove, consulting engineer and president of Optionics Engineering Corp. of Los Angeles, and Carlisle F. Manaugh, owner of Plant Engineering Co. have formed a partnership and opened offices at 1416 Westwood Blvd., Los Angeles 24. The new firm, Grove & Manaugh, will specialize in parking and traffic problems, and in the development of automatic materials handling equipment.



GROVE SHOEMAKER

★ Joseph J. Shoemaker, presently with Detroit Edison Co., is joining the staff of Hinchman Corp. as an Associate. He will assume the duties of manager of the fire protection and safety engineering division.

★ John E. Bock, supervisor of photometric testing for the General Electric's Lighting and Rectifier Department, retired recently after more than 43 years' service with the company. He is the author of numerous articles on lighting and spearheaded a standard method of lighting classification.

★ Wigton-Abbott Corporation is named as architects, engineers and contractors for a new million-dollar research building to be built for The Norwich Pharmacal Company.

★ A new manufacturing plant costing approximately $1 million is being constructed by Barrett-Cravens Company at Northbrook, Ill. A. Epstein and Sons, Inc. are the engineers.

★ Steel framework for the Prudential Insurance Company's 41-story office building in Chicago is being erected. Naess and Murphy are the consultants.

A-S-H HYDROVACING

keeps this new plant spic and span

The William J. Neal Station at Velva, N.D.

Good housekeeping is a watchword at Central Power Electric Cooperative's plant in North Dakota. Located near the Souris River, this new lignite-fired plant is a major factor in developing this rich area.

The installation includes two boilers, each with a steam capacity of 230,000 lb. per hr., a design pressure of 975 psi, and a total temperature of 905°F.

The lignite residue is handled by a pneumatic Hydrovac System equipped with manually-operated valves, and is discharged through primary and secondary collectors into a storage silo.

Power-plant cleanliness with economy is a result of A-S-H pioneering. Ask our engineers for suggestions toward solving your materials handling problem. Write or wire.

THE ALLEN-SHERMAN-HOFF CO.
Dept. M—259 E. Lancaster Ave., Wynnewood, Pa.
Offices and Representatives in Principal Cities

HYDROJET (hydraulic) **HYDROVAC** (pneumatic)

materials handling systems

Draftsman

—Starts on page 20

moved about, is recommended for stationing them. When the layout is completed, photocopies are easily made on a vacuum-bed printer.

Lettering

Lettering the finished drawing is a task that requires a considerable amount of a draftsman's time but does not require actual training in drafting practices. Some consulting firms employ women for this purpose. The draftsman merely pencils in the desired notations and the drawing is passed on to the women for finished lettering. Because of their manual dexterity and patience, women have been found to be particularly adept at this work. In addition, a firm can afford to pay them a comparatively high wage. In most instances, Wrico or Leroy lettering instruments are used; however, special typewriters are being used by some firms.

Design improvements have made typewriters more flexible for use with mechanical drawings. Units having type faces which closely resemble Leroy lettering are available for use on any size of drawing. William Healy and Arthur Rau, in their book, *Simplified Drafting Practices,* quoted data from tests establishing that typing is three to four times faster than freehand lettering. The net saving is even greater when the wage differential between typists and draftsmen is considered. However, because the needs of individual firms vary, typing will not provide savings in all instances.

One machine, known as the Varityper composing machine, features an open-end carriage which handles any size of drawing. This machine offers the additional advantage of interchangeable type faces. It does require a certain amount of training in addition to the usual typing skill, however.

Several electric typewriters are available which can be adapted to engineering drawings. As an example, IBM has a machine that can be furnished with an appropriate type face. This unit allots each character the amount of space required by its width, rather than equal spacing for all letters. It also permits letter and word spacing.

The limiting factor with this type of machine is the length of the carriage. The maximum length available with the IBM machine is 20 in. When larger drawings are involved, perhaps it would prove practical to type all notations on a small sheet of paper for subsequent stripping in on the drawing. Such a procedure would offer the additional advantage of simplifying corrections and changes.

Freehand Drawing

Wider use of freehand drawing offers another possibility for reducing the effort and time required by the draftsman. For many years freehand sketches have been used for field work and in emergencies. Why not adopt a method such as this, which has proven entirely adequate for field and emergency work, to normal operations?

Perhaps the most important single factor retarding universal acceptance of freehand delineation is a general confusion between the meanings of accuracy and precision. When used in conjunction with mechanical drawings, the two words are not synonymous. Correct dimensioning on the drawing equals accuracy, while drawings prepared to an exact scale constitute precision. Except in instances where an exacting scale serves a specific purpose, precision increases the cost of preparation without improving the accuracy of the drawing in any way.

Freehand drawing is not a license for careless, in-

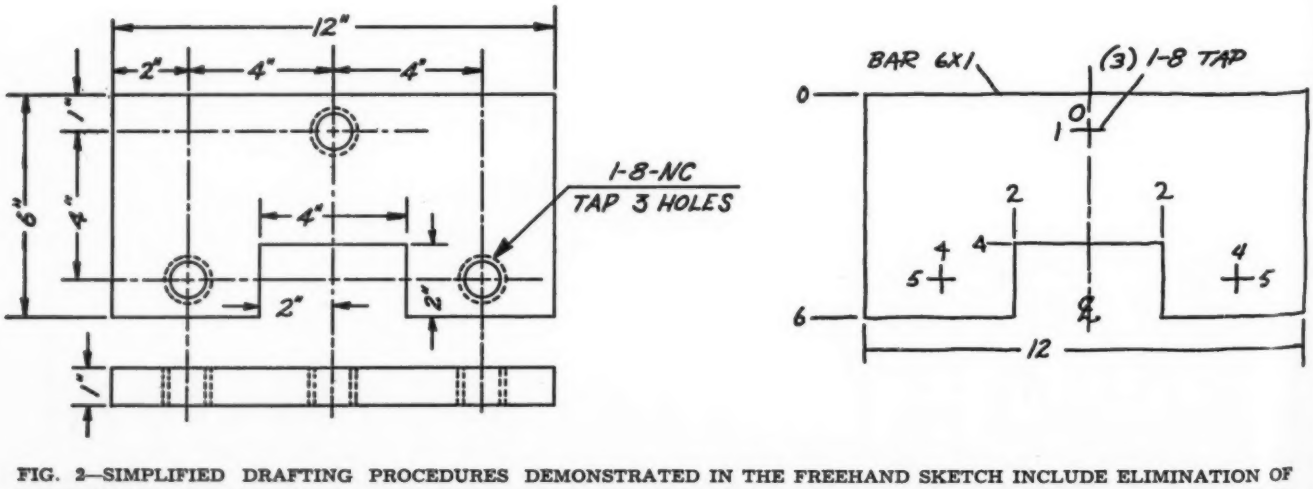


FIG. 2—SIMPLIFIED DRAFTING PROCEDURES DEMONSTRATED IN THE FREEHAND SKETCH INCLUDE ELIMINATION OF UNNECESSARY LINE WORK AND AN UNNECESSARY VIEW, SIMPLIFIED NOTATIONS, AND PROGRESSIVE DIMENSIONING.

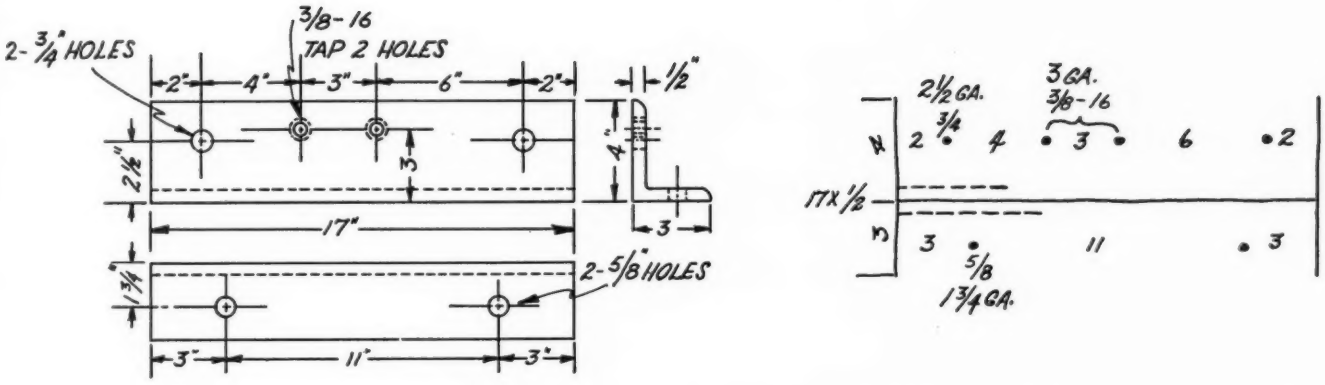


FIG. 3—COMPARISON OF CONVENTIONAL DRAWING WITH SPECIALIZED SIMPLIFICATION DETAILING AN ANGLE-IRON.

different work. Habits which are essential to almost any drawing operation also apply in freehand practice.

Additional Simplifications

Various manufacturing organizations have adopted specialized drawing techniques to meet their particular needs. Although most of these methods are perfectly clear and concise, their radical departure from long-established procedures often causes confusion until adequate instructions for reading are provided. Because of a lack of general industrial acceptance, their use for proposal drawings and those primarily intended for the client is not recommended at the present time.

One simplification which is likely to gain general acceptance in the near future involves the elimination of drawing circles to represent holes. Since the center lines indicate position and the accompanying notations indicate drilling and tapping instructions, why not show the center lines alone?

Another interesting simplification is the use of progressive dimensioning—a method commonly accepted for marking coordinates of graphs. The principle of this method can be readily seen by comparing the two graphs shown in Fig. 4. Progressive dimensioning involves the use of datum lines, usually one for vertical and one for horizontal measurements. All dimensions represent total distance from the proper datum line. In most instances, these dimensions are indicated without the use of arrows. Any lengths not parallel to the datum lines are indicated in the conventional fashion.

Perhaps the most commonly accepted application of progressive dimensioning, as applied to engineering drawings, is the method of indicating elevations on drawings.

A very specialized simplification for preparing detail drawings of structural angle-irons has been successfully adopted by one large organization. Fig. 3 illustrates the conventional method as compared to its simplified counterpart.

In the simplified version, the line of vision is in a direct line with the heel of the angle so that both legs of the angle are projected on the same plane. The holes, irrespective of size or type, are represented by black dots. Drilling and tapping instructions for the holes, and drill gage (center line distance from the heel of the angle), are given above the holes for the upper leg and below the holes for the lower leg. Distances between respective holes are dimensioned without arrows. Leg sizes, thickness, and the over-all length are given on the left end of the sketch.

At first glance the examples of specialized simplifications are unbelievable. However, when the possibilities for reducing time and cost required to prepare drawings are considered, one wonders why these methods have not been more widely accepted.

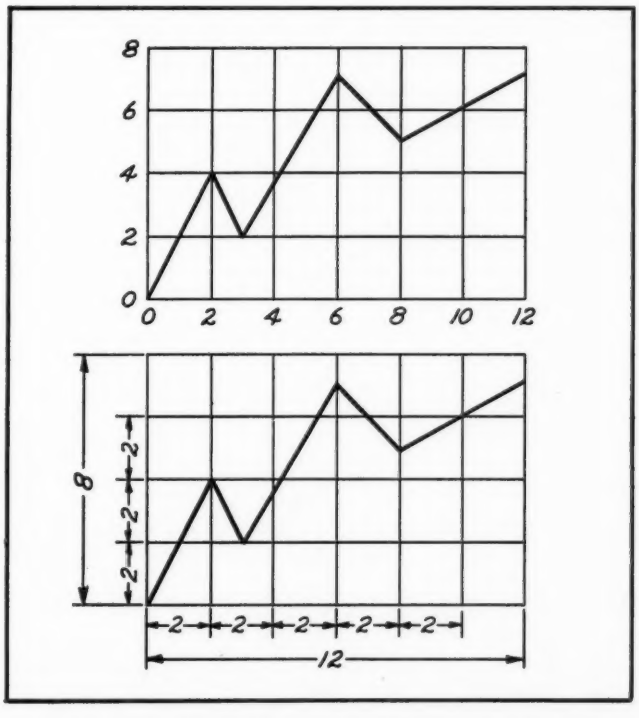


FIG. 4—PROGRESSIVE DIMENSIONING, AS APPLIED TO COORDINATES OF A GRAPH, IS CONTRASTED WITH SEQUENTIAL METHODS USED FOR DRAWINGS.

Fees and Contracts

—Starts on page 28

by the client. Close contact also insures client control of the project, and enables the design-development team to coordinate their developments with the character of the client's company.

Yet, the engineer needs to maintain a clear, undistorted perspective. He should mingle with the client's engineers and designers, but never become one of them. If he were to do this, he would soon lose his objectified creativeness—the chief quality for which he is being paid. He should avoid using the client's engineering personnel as much as possible, but should use the client's facilities whenever it serves to reduce the cost of his services.

Our organization handles this part of the job through a system of project managers. These men command anywhere from three to five project engineers, each of whom is in charge of individual projects. The project manager is the liaison man between our company and the client. Thus, the project manager performs two functions — he conveys the intent of the client to us and he represents our company to the client. In this way we maintain a close contact and still permit the project engineers a large measure of divorcement from the client.

Clients should be encouraged to visit the consulting engineer's plant or base of operations. No attempt should be made by the consultant to resist investigation of his abilities and resources.

Charges to be paid by the client should be detailed. Itemized invoices should be mailed to the client every two weeks. Overtime and double time should be performed only upon the client's authorization in writing. Each client should retain the unquestioned right to end his project at any moment, should he so desire. Regular contact with the client should be maintained to make certain at all times that he is satisfied with the results.

In conclusion, the manufacturer seeking outside engineering assistance, not mere drafting muscle, should be able to expect and rely upon consulting organizations to offer a complete engineering service, to operate in complete confidence, to handle all problems in a thoroughly professional manner, and to refrain from unethical tactics.

Planning a Plant

—Starts on page 39

of take-home pay—than those they formerly held. Judgments were based on thorough reviews of each employee and his skills insofar as he or she was qualified to fit in with the new machinery. From a total of 70 employees required in the former plating operations, approximately 23 (or 30 percent) are now working at other jobs in the division.

Operations were further simplified by eliminating the old system involving five rate classifications which depended upon individual skills. Now, each machine is assigned a plater or lead man; all others concerned with the machine's operations are classified as plater's helpers. This was possible because the almost automatic nature of the equipment does not require any particular skill, whereas equipment in the old department did.

Prior to the opening, all employees that were to be retained entered into a two-week training period. During this time, they were instructed in the nature of the equipment, proper operation of controls, and so forth. To maintain production, shipping schedules were temporarily met in both the old and new installations. Equipment was transferred at night.

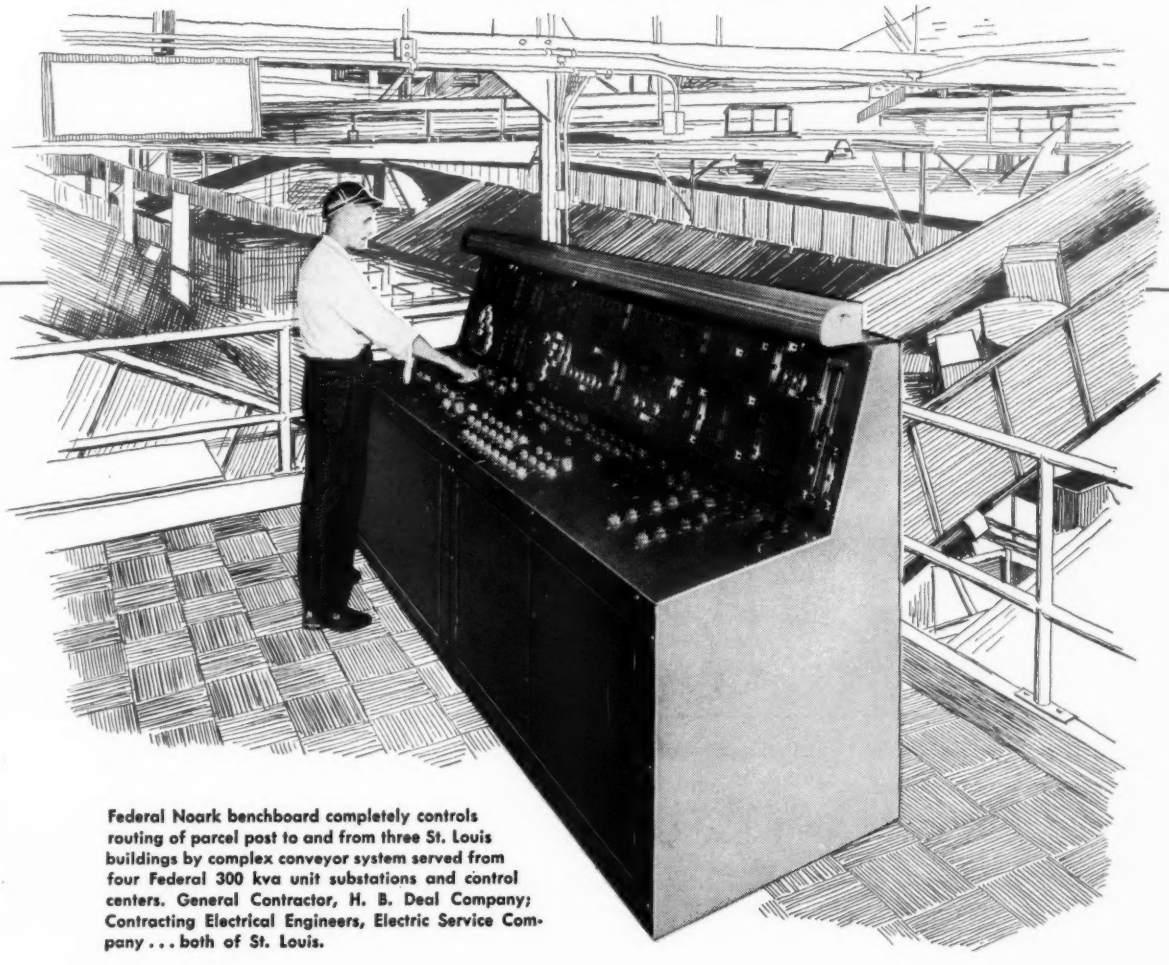
As is customary with new plants, the shakedown operation has brought some problems. The equipment had to be adapted to the plating specifications. Greater depth and closer tolerances were required than commercial plating. This meant that many new fixtures had to be designed. And conversely, adaption was necessary to the commercial plating which would come in and its different requirements.

Added Benefits

An added indirect benefit has been achieved by adding the 10,000 square feet of floor space occupied by the old installation to the electrical relay department. The latter had been located on the fifth floor for the most part; a portion was situated in another building.

Based on the over-all company program, the new plating plant is expected to go on a 24-hour schedule within three to four years. Presently, operating at 40 percent of capacity, a full crew is used on one shift, and skeleton crews on the other two. The plant can be converted to 24-hour production within 30 days. This is how the US and S installation for job-lot plating on a production basis came into existence.

NOW! FEDERAL NOARK® HELPS SPEED ST. LOUIS MAIL



Federal Noark benchboard completely controls routing of parcel post to and from three St. Louis buildings by complex conveyor system served from four Federal 300 kva unit substations and control centers. General Contractor, H. B. Deal Company; Contracting Electrical Engineers, Electric Service Company . . . both of St. Louis.

PARCEL POST in St. Louis is now rapidly moved by the Terminal Railroad Association's new conveyor system from Union Station, a new Terminal building, and the Post Office. This system, the most elaborate of its kind in the country, is powered from four Federal Noark Unit Substations and controlled by a specially-designed Federal Noark indicating bench board.

The unit substations are 300 kva, 4180/480 volt, 3-phase. Each has a three-position fused primary selector switch so that either of two primary sources can be selected. Each station has a main secondary breaker feeding a close-coupled control center. Secondaries from all units can be tied together through Federal Noark Bus Duct.

The benchboard completely outlines the entire system and can select any number of conveyor arrangements which are instantly indicated by illuminated routings shown in miniature.

Here is another example of Federal's ability to handle your distribution or control problems. Remember, Federal Noark has the engineering skill and manufacturing facilities to provide exactly the right equipment for your requirements.

Federal Electric Products Company
50 Paris Street, Newark 5, New Jersey

Federal Noark products: Stab-lok Circuit Breakers, Motor Controls, Safety Switches, Service Equipment, Industrial Circuit Breakers, Panelboards, Switchboards, Control Centers, Bus Duct — **Pacific Electric Manufacturing Corporation products:** High voltage circuit breakers and power switches ★ Sales offices in principal cities.

FEDERAL NOARK

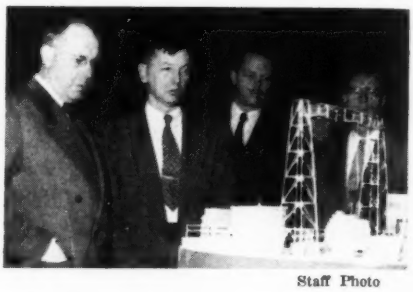
Atomic Energy in Industry

CE *attends*

SOME 1500 to 2000 men attended the second annual conference on Atomic Energy in Industry sponsored by the National Industrial Conference Board. Held in New York City's Waldorf-Astoria Hotel, the two-day session attracted overflow audiences in many cases. Headline speakers were George M. Gadsby and W. Sterling Cole who addressed the evening banquet session; featured speaker at the closing luncheon meeting was Sir Christopher Hinton, deputy controller of Great Britain's Atomic Energy (Production) Ministry of Supply. Hinton indicated in a press conference that Great Britain stands ready to cooperate with the United States in a freer exchange of atomic data. He did not feel that previous and existing restrictions are altogether without value since they force independent action and thinking. (See *Atoms in Action*, p 18) for round-up of speakers' opinions.

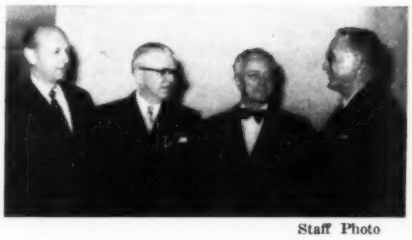
Staff Photo

ROBERT W. POWELL, head of reactor operations division, Brookhaven National Laboratories; T. O. Kuivinen, chief engineer's assistant, Cooper-Bessemer; and Malcolm E. Lambing, vice president, Peoples First National Bank of Pittsburgh (l. to r.).



Staff Photo

S. ARNOLD SMITH, chief engineer, Whitlock Mfg. Co.; Raymond B. Prouty, vice president, Whitlock Mfg. Co.; Walter A. Grant, vice president, Carrier Corp.; and R. O. Morse, manager of research and development laboratories, Canadian Westinghouse (l. to r.).



Staff Photo

DAVID E. LILIENTHAL, former chairman, U. S. Atomic Energy Commission; George M. Gadsby, president, Utah Light and Power Co.; W. Sterling Cole, U. S. House of Representatives and chairman of the Joint Atomic Energy Committee; and John S. Sinclair, president, National Industrial Conference Board (l. to r.).

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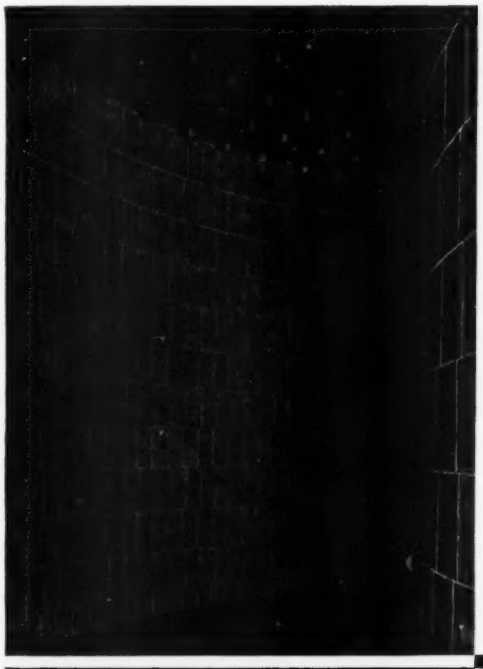

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All of the important features of suspended construction—inherent in the B-L design—are included in Bigelow's abrasion-resistant linings for bead catalyst units.

1. Horizontal tile joints slope downward to resist bead infiltration.
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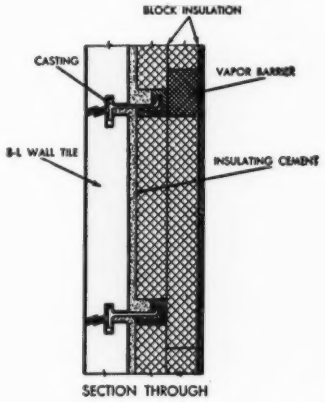

SECTION THROUGH

CASTABLE LININGS

B-L provides a source for a *complete* job—engineering, materials, complete erection—of pneumatically-applied castable linings for fluid catalyst units, cyclones, pipes, stacks and ducts.

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4. Design provides for panel expansion.
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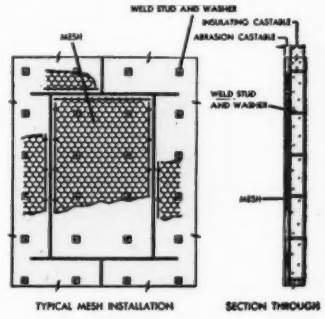

TYPICAL MESH INSTALLATION SECTION THROUGH

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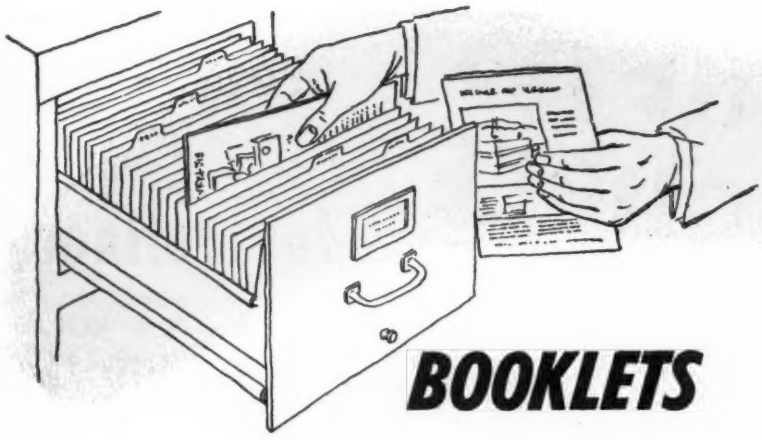


BOOKLETS

STEAM TRAPS and temperature controls are described in a group of bulletins bound together for use as a condensed catalog. A complete index of the various products makes this a useful handbook. *Sarco Co., Inc., Empire State Bldg., New York 1, N. Y.*

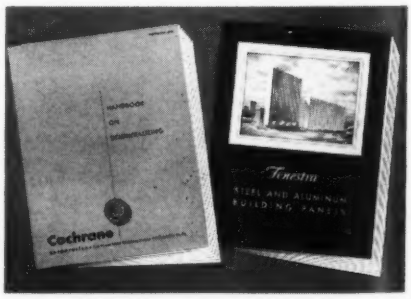
STEAM GENERATING units and allied equipment of various designs are shown in typical installations in 19-page bulletin G.B.-153. Boilers available in eight basic arrangements of two, three, and four drum types adaptable to all methods of firing are illustrated along with heat recovery units and process equipment. *Union Iron Works, Erie, Pa.*

FUEL SYSTEMS — Over 50 years of experience in steam generation backs up 29-page bulletin "Pulverized Fuel Systems." Well illustrated with cross-sectional drawings and graphs, it gives advantages, typical installations, and descriptions of major operating parts. *Foster Wheeler Corp., 165 Broadway, N. Y. 6, N. Y.*

PRESSURE RELIEF VALVES — "Selection and Sizing Pressure Relief Valves to Comply With ASME Boiler Code Requirements," a 24-page booklet published as a contribution to the heating industry, provides complete and easy-to-use data for accurately determining the output of all types of boilers, tanks, and heaters. Formulas and tables cover recommended relief valves for cast-iron and steel boilers, as well as those boilers for which there is no nameplate data or set procedures for establishing the output. *McDonnell & Miller, Inc., 3500 N. Spaulding Ave., Chicago, Ill.*

"AUTOMATIC pH CONTROL in Water and Industrial Waste Treatment," 8-page booklet, is a reissue of a paper delivered by R. T. Sheen, president of this company. Outlined are several typical systems of automatic pH control in boiler feed water treatment, using air-and motor-operated valves as well as controlled volume pumps to effect proper addition of chemicals. Diagrams of actual installations illustrate the bulletin. *Milton Roy Co., 1300 E. Mermaid Lane, Philadelphia 18, Penn.*

"HANDBOOK ON DEMINERALIZING," 39-pages, No. 5800 answers such questions as when to use three or four-bed rather than two-bed demineralizers; should a decarbonator be included; how to figure operating costs; and what ion exchange material to specify. Contains flow diagrams and installation pictures. *Cochrane Corp., 3172 N. 17th St., Philadelphia 32, Pa.*



"STEEL AND ALUMINUM BUILDING PANELS," 42-page catalog 23M gives complete descriptions of Fenestra panels for floors, walls, roofs, and ceilings, including the new Fluted Insulated Wall section, Type F. Cross sections illustrate how panels are attached to supports. Engineering data are included in tables. *Detroit Steel Products Co., 2250 E. Grand Blvd., Detroit 11, Michigan.*

INDUSTRIAL LAYOUTS — Two folders explain the use of a prefabricated method of making plant layouts and organizational charts. Drawings are included of the various pressure-sensitive tapes and cut-outs available. *Chart-Pak Inc., 104 Lincoln Ave., Stamford, Conn.*

"RESEARCH in Production Engineering," a 5-page booklet explains

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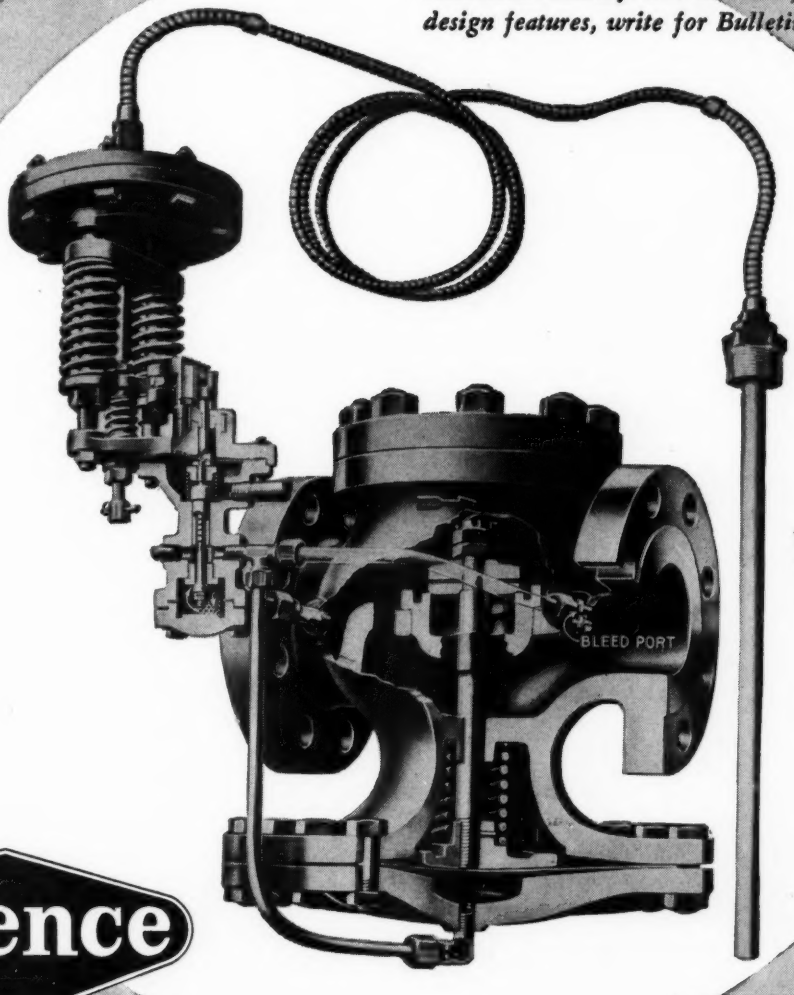

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BOOKLETS —Starts on page 74

predesign evaluation of materials and methods, product development, and development of production equipment by this institute. Examples of problems are given along with a list of the fields of research. *Battelle Memorial Institute, 505 King Ave., Columbus 1, Ohio.*

ROLLING SERVICE DOORS—12-page catalog 301 illustrates this company's complete line of steel doors, fire doors, grilles, aluminum rolling counter doors, and specialty doors. Primary feature of the booklet is a series of charts designed to simplify selection of proper gage and type of slats, guide type, power units, and other components. Blueprints of 12 basic types show all necessary architectural dimensions. *The Cookson Co., 1525 Cortland Ave., San Francisco 10, Calif.*

"FROM ONE DESIGNER to Another," tells how to design parts to be machined from Mycolex glass-bonded mica. This 24-page handbook explains the design alternatives which are to be preferred for arriving at a satisfactory design having the lowest production cost. Included are tables, specifications charts, and workbench sketches. *Mycalex Corp. of America, 30 Rockefeller Plaza, N. Y. 20, N. Y.*

BUS DUCT—16-page bulletin BD-755 gives information on the features and uses of Plug-In BUStribution Duct. It also contains samples of layouts illustrating the way in which these fittings are used to simplify installation of electric duct. This class of duct is suited to factories, commercial buildings, and institutions. *BullDog Electric Products Co., Detroit 32, Mich.*

"PRESSURE-TEMPERATURE RATINGS of Plain End Pipe Used in Power Plant Piping Systems," technical bulletin TB1-1953, will be of help to anyone concerned with the design of piping. These ratings have been calculated by the recently revised formula and allowable stress values applying to the ASA Code for Pressure Piping and the ASME Power Boiler Code. *The Pipe Fabrication Institute, 813 Clark Bldg., Pittsburgh 22, Pa.*

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CABLE ACCESSORIES—Publication No. C-79-13-14 is a combination of Sections 13 and 14 of Anaconda's General Catalog No. C-79. It contains pertinent information on potheads, filling compounds, paints, and allied items with complete discussion of their features, applications, and installation information. Catalog also includes data on joints, connectors, rolling tools, drawbenches, tie wire, armor rods, and accessories for AGSR and steel ground wire. *Anaconda Wire & Cable Co., Fred Luna, Director of Sales Promotion, 25 Broadway, N. Y. 4, N. Y.*

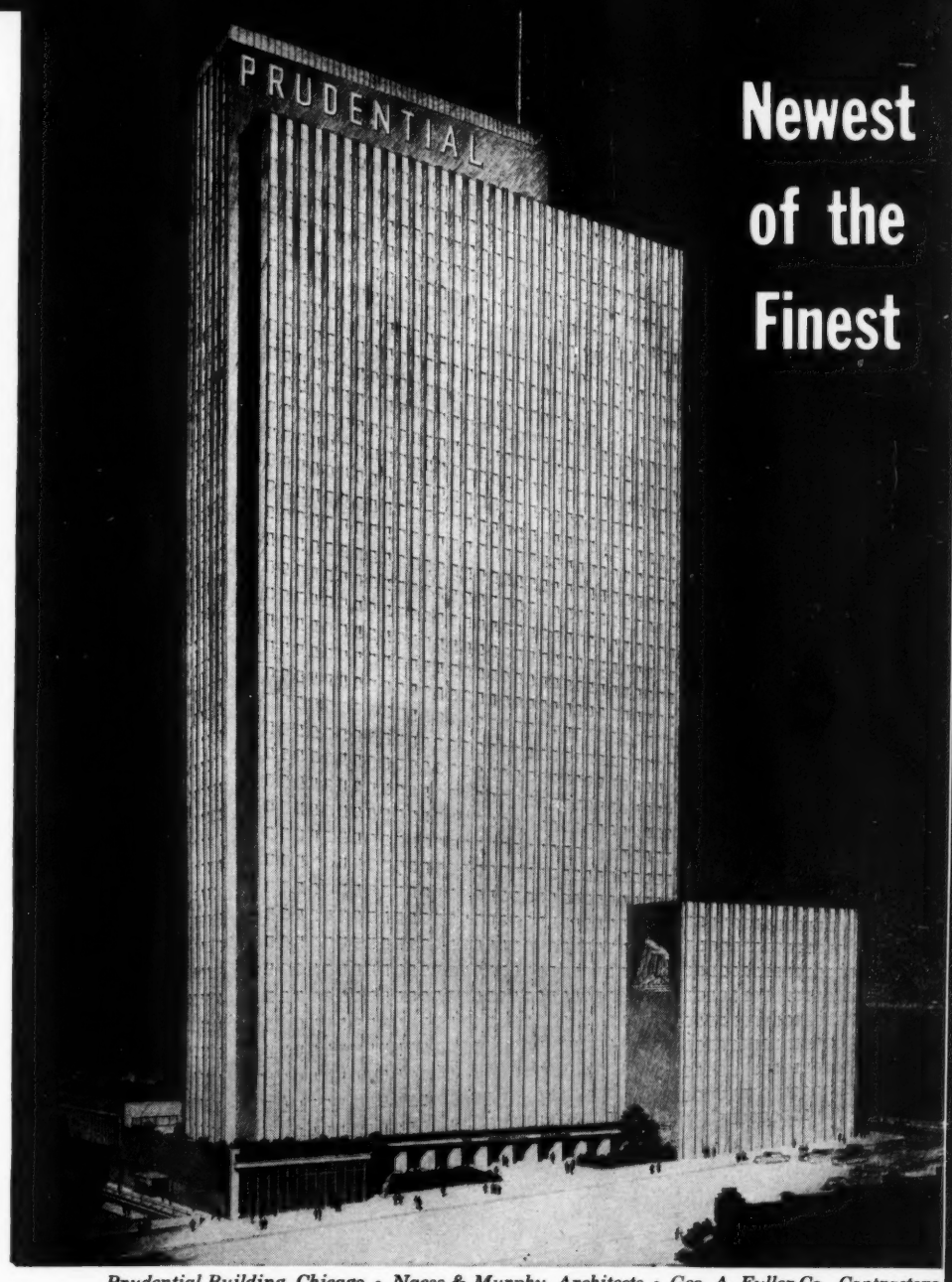
LIQUID LEVEL GAGES, transparent type, are designed for service on new equipment or to replace old-style tubular gages, according to 4-page folder 200. Cross-sectional drawings of gage construction and dimensions are supplemented by tables of specifications and pressure-temperature graphs. *Jerguson Gage & Valve Co., 80 Fellsway, Somerville 45, Mass.*

DRY-TYPE DISTRIBUTION TRANSFORMERS described in 4-page folder EU-106, No. 12 are Class B insulated 80 C rise dry-type transformers, in ratings 3 through 100 kva, single-phase, 600 v and below. Advantages of the reduced size and weight are given. *Wagner Electric Corp., Sales Promotion Dept., Electrical Div., 6400 Plymouth Ave., St. Louis 14, Mo.*

MATERIALS HANDLING, Style J Vibrex vibrating screen is described in 8-page bulletin No. 122-J as a low-priced screen of simple, rugged design, easy to install, operate, and maintain. Pictured examples of its use in plants are supplemented by dimensional drawings and specification tables. *Hewitt-Robins, Inc., 666 Glenbrook Rd., Stamford, Conn.*

PORTABLE SPACE HEATERS—38-page booklet emphasizes the importance of safety in connection with portable space heaters. Heaters described can be used for pre-heating engines and equipment on construction jobs, in warehouses, drying stock-piled concrete blocks, brick, or lumber for ship-building—or wherever emergency or temporary work is required. Air is directed to the area to be heated through flexible canvas ducts. *American Air Filter Co., Inc., Louisville 8, Ky.*

"CORROSION RESISTANCE of Copper and Copper Alloys," 27-page booklet B-36, has been designed to assist the materials engineer in selecting the copper alloy best suited for a specific use. Corrosion theory, types of corrosion, and general resistance are discussed. Charts show the resistance of copper and commonly used copper alloys. *The American Brass Co., Waterbury 20, Conn.*



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consulting engineers' calendar

Date	Sponsor	Event	Location
Nov. 18-19	National Metal Trades Association	53rd Annual Convention	Cleveland, Ohio
Nov. 29-Dec. 4	American Society of Mechanical Engineers	Annual Meeting	Statler Hotel New York, N. Y.
Nov. 30-Dec. 5	Exposition of Chemical Industries	Exhibit	Commercial Museum Philadelphia, Pa.
Dec. 2	American Institute of Consulting Engineers	Luncheon Meeting	City Midday Club New York, N. Y.
Dec. 8-10	American Institute of Electrical Engineers	Computer Conference	Statler Hotel Washington, D. C.
Dec. 13-16	American Institute of Chemical Engineers	Annual Meeting	Jefferson Hotel St. Louis, Mo.
Jan. 18-22	American Institute of Electrical Engineers	Winter Meeting	Statler Hotel New York, N. Y.
Jan. 25-27	American Society of Heating and Ventilating Engineers	60th Annual Meeting	Rice Hotel Houston, Texas
Jan. 25-28	Plant Maintenance & Engineering Show	Exposition	Conrad Hilton Hotel Chicago, Ill.
March 15-19	National Association of Corrosion Engineers	10th Annual Conferences	Muehlebach Hotel Kansas City, Mo.
April 1-3	Electrical Maintenance Engineers Assoc. of Southern Calif.	7th Electrical Industry Show	Shrine Hall Los Angeles
April 15-19	American Institute of Electrical Engineers	Southern Textile Conference	Georgia Tech. Atlanta, Ga.
April 26-30	American Society of Tool Engineers	Industrial Exposition	Convention Center Philadelphia, Pa.
April 27	Association of Consulting Chemist and Chemical Engineers	Symposium-Banquet	Hotel Belmont Plaza New York, N. Y.
May 4-7	American Welding Society	Spring Meeting	Hotel Statler Buffalo, N. Y.
May 23-28	American Water Works Association	National Convention	Seattle, Wash.
May 24-27	University of Michigan	Instrumentation and Industrial Hygiene	Rockham Bldg. Ann Arbor, Mich.
July 13-15	Western Plant Maintenance Show	Conference and Exposition	Pan Pacific Bldg. Los Angeles, Calif.

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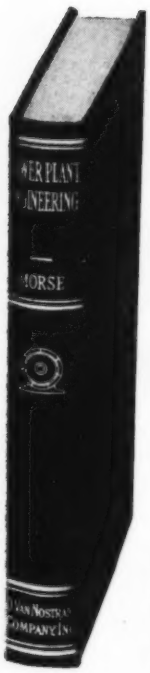

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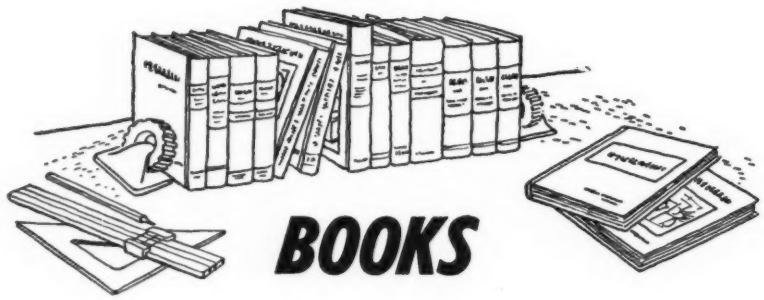

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Department of Civil Engineering
University of Virginia

Although interest in the field of prestressed concrete construction is growing rapidly in this country, prestressing has certain disadvantages, and should not be considered a substitute for all other reinforced concrete construction. Also, as the author points out in the preface, a special study of statically indeterminate systems is necessary. The details and procedures to be used in such redundant structures will be discussed in a second volume.

This first volume has been restricted to statically determinate straight beams. This application of prestressing constitutes only a part of this broad field of construction. However, a thorough understanding of the many problems encountered in the design of simple beams will be of value in the consideration of statically indeterminate systems.

The basic principles of the analysis of prestressed concrete and the design of beams of constant cross-section and beams of variable depth are analyzed. The theory of anchorage zone stresses in post-tensioned and pre-tensioned beams is thoroughly discussed. Shrinkage and plastic flow of concrete, and the creep of steel are well presented in the chapter on "Materials."

Because the hypothesis which constitutes the basis of all practical design work is only approximately true, it is essential that the results of experimental tests be carefully analyzed. Guyon very clearly presents the results of three representative tests of beams prestressed with cables. These examples show the need for additional experimental work.

Minor changes have been made in this translation to broaden the book's appeal, and all examples are worked in British dimensions.

As a student of E. Freyssinet, Guyon is especially qualified to write this very useful contribution in an important field.

POWER PLANT ENGINEERING, by Frederick T. Morse, D. Van Nostrand Company, Inc., $8.75.

Power plant engineers and consultants in the power field will be interested in the recent publication of the Third Edition of a volume which has become, during the past fifteen years, one of the standard texts and reference books dealing with the theory and practice of stationary electric generating plants. Many practicing engineers used *Power Plant Engineering and Design* as their college text and have used it in their work during the succeeding years.

Not only has the title been changed, but the whole volume has been rewritten and rearranged to fit it to current engineering needs. The old chapters on hydraulic power and electrical equipment have been deleted as unsuited to the text, but the section on steam plant equipment has been greatly expanded, and a new chapter has been added on the gas turbine. The objective continues to be the presentation of a useful study of stationary power and heating plants including public service, industrial, and institutional installations.

While, on the one hand, the book may be said to try to cover too much subject matter to do a thorough job (any one of the chapters, Power Plant Building Materials,

Fuels and Combustion, or Vapor Cycles, for example, could be expanded into several volumes without danger of becoming definitive) its value is perhaps increased by this very scheme. It is obviously handy and time saving to have so much coverage in one volume, and the reader needing more material on specific subjects can easily refer to other more specialized texts.

BILLINGS AND WATER POWER IN BRAZIL, by Adolph J. Ackerman; published by the author and the American Society of Civil Engineers.

This book is essentially the biography of Asa White Kenney Billings. It is an easily read account of engineering problems, solutions, and execution involved in his direction of Brazil's program to harness the energy in the waters of the Serra Plateau. The author likens Billings to Ford, Mellon, and Rockefeller the analogy being that all were men of great capability who came on the scene when a job existed which matched their prowess. In Billings' case, hydroelectric engineering was the job to be done on a grand scale in Brazil. The book is not a schoolboy's biography but is rather an account of engineering achievement.

ALSO AVAILABLE

ESSENTIALS IN PROBLEM SOLVING by Zuce Kogan, 80 pages, $3.00. This little book sets forth a method for tackling difficult and unfamiliar problems. It develops certain rules or tools called "approaches" that make the task of thinking creatively and of solving problems easier.

ENGINEERING FORMULAS & TABLES, Lefax Publishers, 350 pages, $2.75. Designed for the use of civil, mechanical, and electrical engineers, this newly revised publication is made up of 12 divisions dealing with mathematics, measures, materials, gages, screws, mechanics, electricity and magnetism, hydraulics, structural data, reinforced concrete, pipe and fittings, steam tables, and mathematical tables.

TAX PLANNING FOR FOUNDATIONS AND CHARITABLE GIVING, by William J. Casey, J. K. Lasser, and Walter Lord, Business Reports, Inc., 236 pages, $12.50. This study points out that individuals get special benefits from the establishment of a foundation in estate planning. By giving to a foundation, they can cut the size of their estate and hence cut the death tax load, which otherwise might force the sale of desirable property. It tells how companies and individuals can take maximum deduction yet make orderly, systematic gifts. Besides a complete analysis of the advantages of establishing a foundation, this book discusses every phase of charitable giving. It explains how to make sure a donor gets his deduction. It analyzes the legal questions of corporate giving. It discusses how and when a contribution might be properly designated a business expense, thus avoiding the Treasury's ceiling on charitable gifts. It explains the savings achieved by giving property instead of money. It has an appendix which shows foundation charters, charitable trust instruments, how to get Treasury approval of tax exemptions, and other practical phases of this subject.

SUGGESTED FORM OF CONTRACT FOR USE IN CONNECTION WITH ENGINEERING CONSTRUCTION PROJECTS, American Society of Civil Engineers and The Associated General Contractors of America, 15 pages, 25¢. This document replaces an older form that had been unchanged since 1925. The material includes (1) the contract agreement itself, covering the three alternative bases of payment to the contractor, i.e., lump sum, unit price and cost plus, and (2) the general conditions of the contract. Included in the contract agreement are articles covering the scope of the work; time of completion; the contract sum; progress payments, force account work; and acceptance and final payment.

REVISIONS OF AMERICAN STANDARDS on transformers, regulators and reactors may be obtained from American Standards Association, Inc., 70 East 45 Street, New York 17, N. Y. at the following prices:

C57.10-1953 American Standard Terminology for Transformers, Regulators and Reactors. Gratis.

C57.11-1953 American Standard General Requirements for Transformers, Regulators and Reactors. Gratis.

C57.13-1953 American Standard Requirements for Instrument Transformers and Table of Contents. $1.00.

C57.33-1953 American Standard Guide for Loading and Operation of Instrument Transformers. $.35.

GASIFICATION OF HYDROCARBONS, by Dr. Jerome J. Morgan, Moore Publishing Company, $4.75. Purpose of the book is to show gas utility companies why they should build auxiliary production facilities to supplement natural gas in city supplies, and to explain how to determine what facilities are best suited to their local conditions.

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